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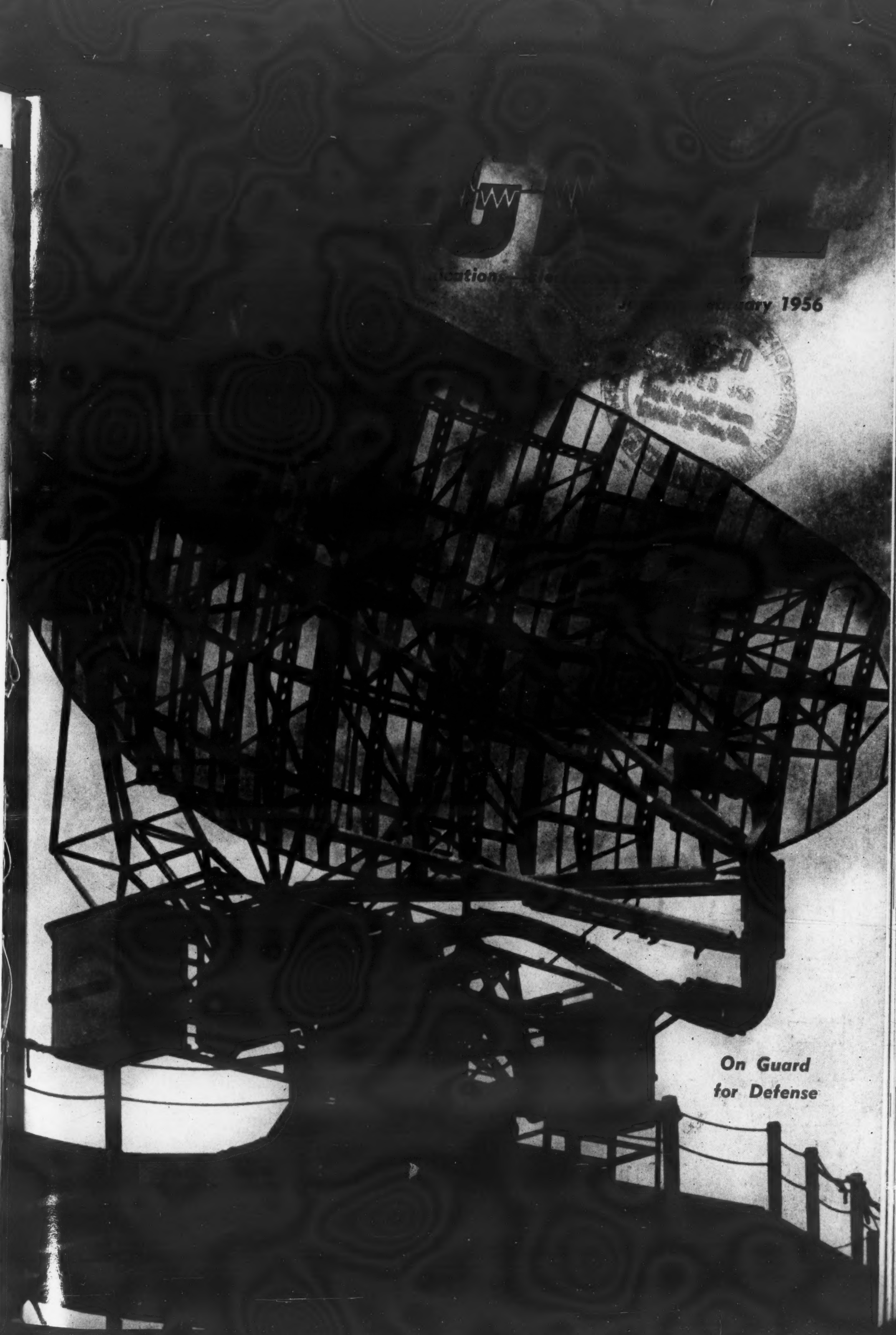


D O T DOTS

UTC has been the leader in miniaturization for over twenty years. In view of this, it was surprising to many people that UTC did not quickly bring out a series of transformers designed for use and comparable in size to transistors. Unfortunately, extremely miniature transistor transformers of standard construction had poor general characteristics, poor reliability characteristics, and were woefully inadequate for a large number of applications. Instead, UTC started a development program to evolve a new transistor transformer structure designed to provide full performance in extremely miniature size. The culmination of this development is found in the new DOT series**. Listed below are the standard types of DOTS now being made and curves showing their general characteristics in typical transistor application. To fully appreciate the unprecedented performance of these revolutionary transistor transformers, the curves also show characteristics of similar size units now on the market.

Special DOT units (some even smaller in size) are available on production order.

High Power Rating . . . up to 100 times greater.
DOT-1 has 5% distortion at 100 mw, other mfr. 6% at 1 mw.

Excellent Response . . . twice as good at low end.
DOT-3 is down 1 db at 200 cycles, other mfr. is down 4 db.

Low Distortion . . . reduced 80%.
DOT-1 shows 3% distortion where other mfr. shows 20%.

High Efficiency . . . up to 30% better.
DOT-1 has 850 ohm pri. resistance, 125 ohm sec.; other mfr. approx. 1200 and 200.

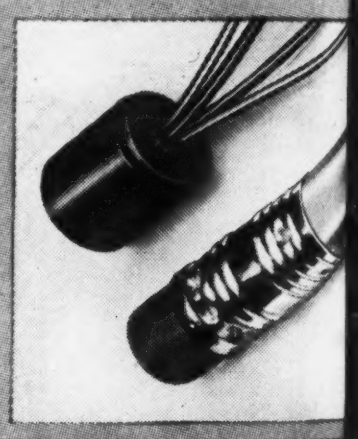
Moisture Proof . . . processed to hermetic specs.
DOT units are hermetic sealed compared to other mfr. open structures.

Rugged . . . completely cased.
DOT units can withstand all mechanical stresses.

Anchored leads . . . will withstand 10 pound pull test.
Lead strain completely isolated from coil winding.

Printed Circuit Use . . . plastic insulated leads at one end.
Other variations available.

1.3 X ACTUAL SIZE



DOT CASE
Diameter . . . . . 5/16"
Length . . . . . 13/32"
Weight . . . . . 1/10 oz.

Type No.	Application	Level Mw.	Pri. Imp.	D.C. Ma. In Pri.	Sec. Imp.	Pri. Res.	Sec. Res.
DOT-1	Interstage	50	30,000 20,000	.5 .5	1200 800	850	125
DOT-2	Output	100	600 500	3 3	60 50	60	8
DOT-3	Output	100	1200 1000	3 3	60 50	115	8
DOT-4	Output	100	600	3	3.2	60	.5
DOT-5	Output	100	1200	2	3.2	115	.5
DOT-6	Output	100	10,000	1	3.2	1000	.7
DOT-7	Input	25	200,000	0	1000	3700	100
DOT-8	Reactor	3.5 Hys. at 2 Ma. DC, 630 ohms. DC res.					

*DOT units have been designed for transistor applications only . . . not for vacuum tube service **Pats. Pending

"The Voice With a Smile"

MISS SERVICE REPRESENTATIVE
"The Voice With a Smile" in the telephone Business Office

One of the nicest things about telephone service is "The Voice With a Smile." It runs all through the business.

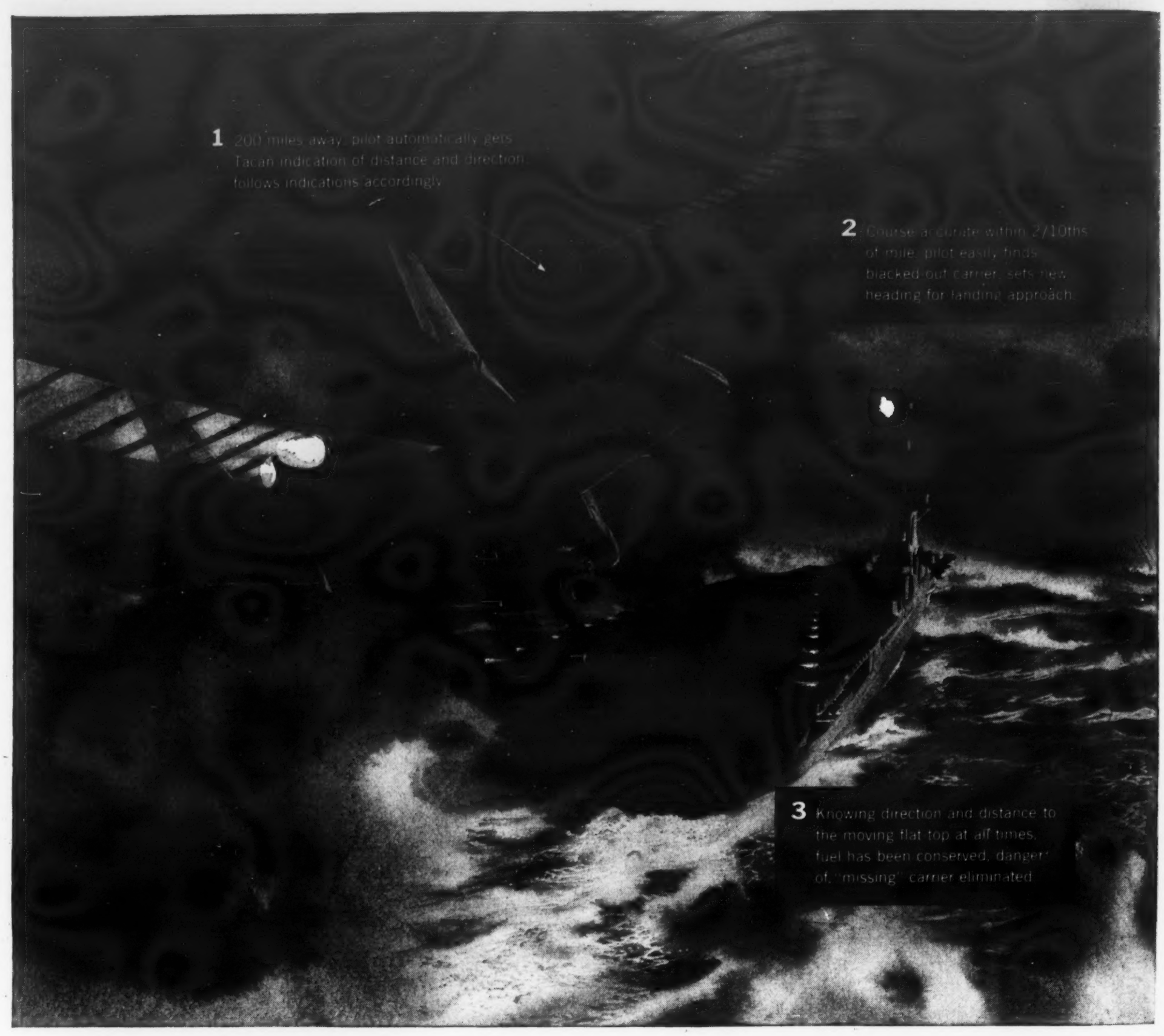
Millions of times a day the operators send it singing over the wires. You hear it when you visit the Business Office or telephone the service representative.

The installer brings it to your home when he comes to put in telephones. The lineman has it as he works along the road or gives you the right of way at a busy intersection.

In talking about telephone people and the way they go about their work, we'd like to say a good word for you, too.

For it's your friendliness that helps us do the kind of job you want us to do. And that means better service for everybody . . . all along the line.

BELL TELEPHONE SYSTEM


1 200 miles away, pilot automatically gets Tacan indication of distance and direction, follows indications accordingly.
2 Course accurate within 2/10ths of mile, pilot easily finds blacked-out carrier, sets new heading for landing approach.
3 Knowing direction and distance to the moving flat top at all times, fuel has been conserved, danger of "missing" carrier eliminated.

NEW DEVICE GIVES PILOT HIS POSITION

Tacan Shows Distance and Direction

THE STORY BEHIND THE STORY:

■ The ocean is a big place. And it's especially big if you're a jet fighter pilot trying to find your carrier base in pitch darkness. With no other place to land, you'd like the shortest route to the carrier's deck. If you had a radio beacon on the carrier it could provide you with continuous information on the position of your aircraft – instantly, automatically, accurately. TACAN (the new Tactical Air Navigation system) provides such a beacon to guide you home.

■ Developed for the Navy by IT&T's Federal Telecommunication Laboratories and manufactured by Federal Telephone & Radio Company, Tacan owes much of its power, range and dependability to the Model SAL-39 Klystron designed for the project by Sperry. This tube, located in the land or ship-based beacon, faithfully amplifies stable radio signals . . . which have been generated within the system . . . to the power required for Tacan's operation. Requiring little or no attention during its long life, the SAL-39 helps assure that the beacons will always be "on the air" as dependable navigation aids.

■ With the addition of the new Klystron developed for Tacan, Sperry now produces more than 85 types of tubes to power other microwave systems—ranging in power from a few thousandths of a watt to many millions of watts and in frequencies covering the microwave radio spectrum. To meet industrial as well as military demands, a complete new plant is now devoted to their design and manufacture in Gainesville, Florida.

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Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME 10 JANUARY-FEBRUARY 1956 NUMBER 3

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Integrated in the ground radar network which protects the United States, the equipment shown on the cover is the antenna and temperate tower mount of a heavy radar set. For more about our defense system, see General Blake's article on SAGE on page 15.

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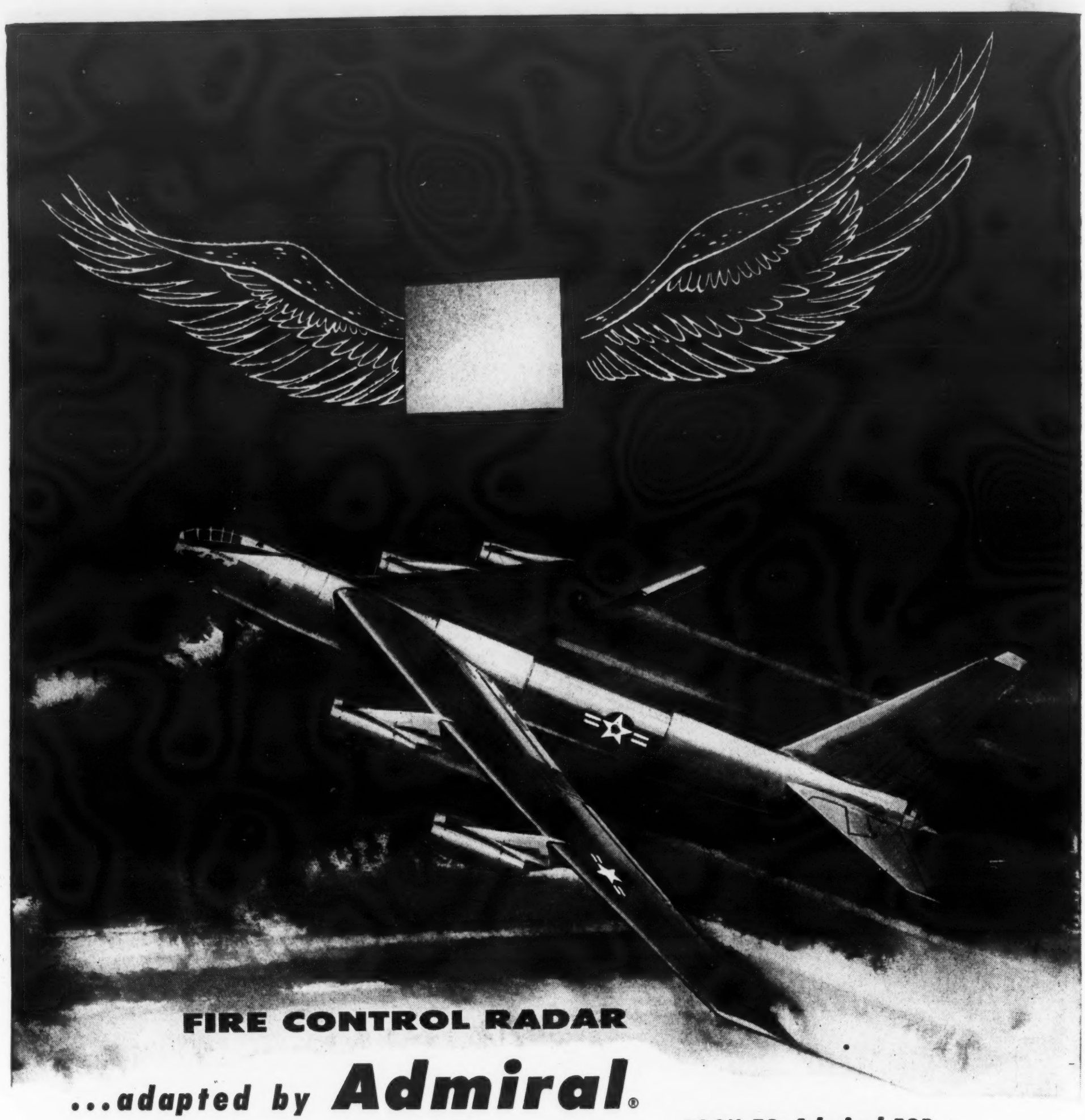

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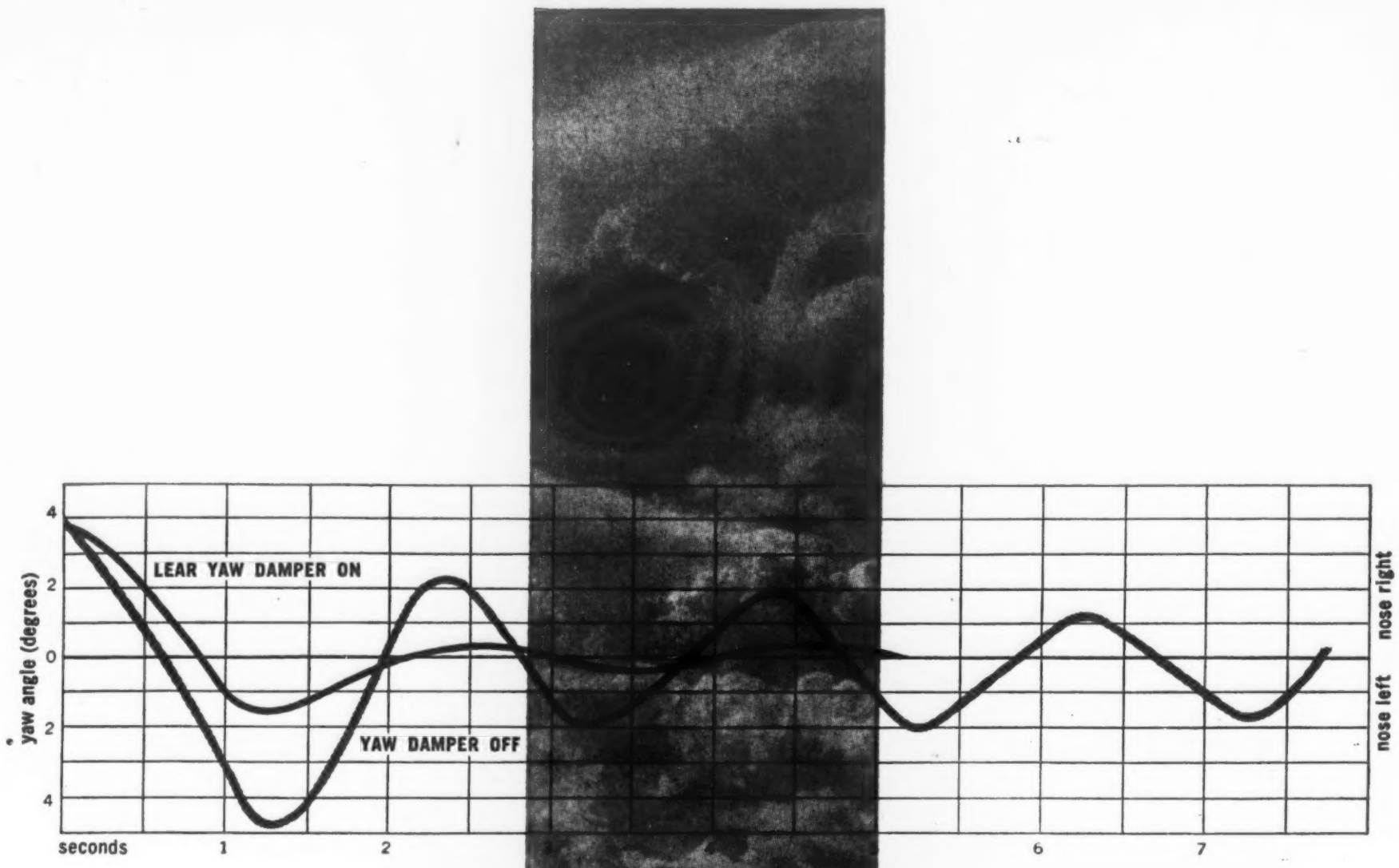

The NAA data presented here show the difference in damping time between Lear Yaw Damper "off" and Yaw Damper "on" operation, starting from steady side slips with full rudder, at .9 Mach number, altitude 40,000 feet.

to increase "kill" probability

Weapon system design combines many arts for the purpose of annihilating the enemy. The spectacular stabilizing effect of the Lear Yaw Damper on the flight path of the F-86D Sabre is shown in the above curves prepared by North American Aviation, Inc., for the enlightenment of fighter pilots. "From these data," says NAA, "it is clearly seen why the yaw damper is an essential device to make your airplane a more effective and efficient rocket firing platform."

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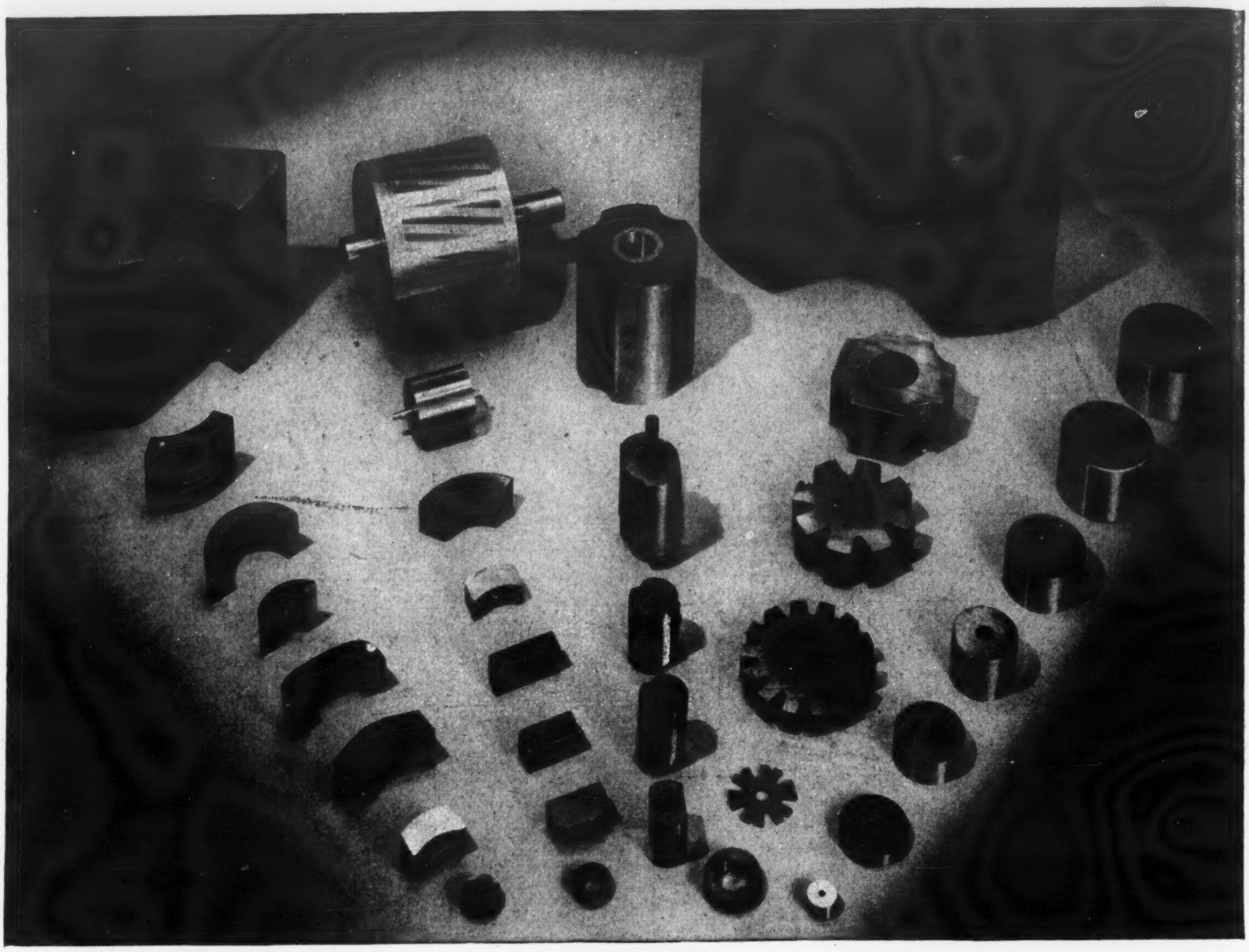

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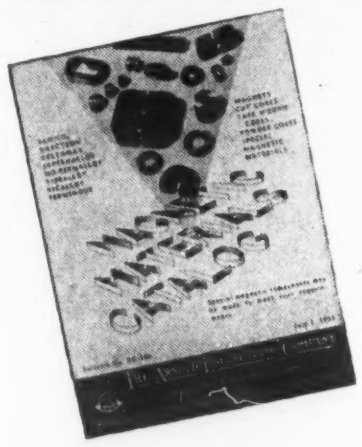

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Write for your copy

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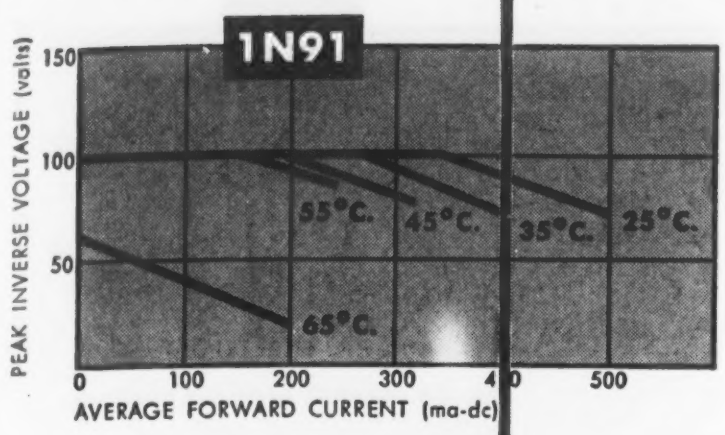
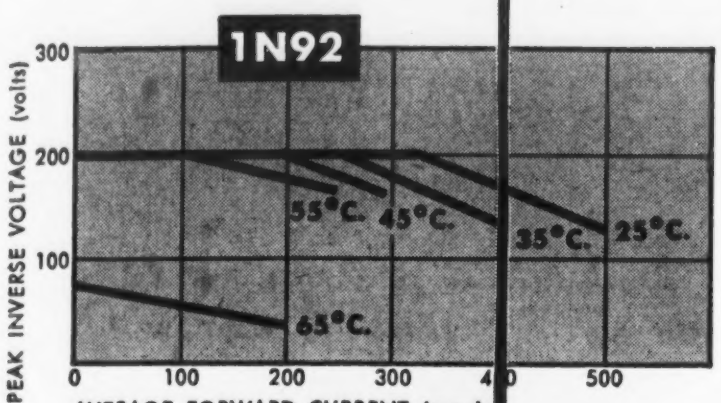
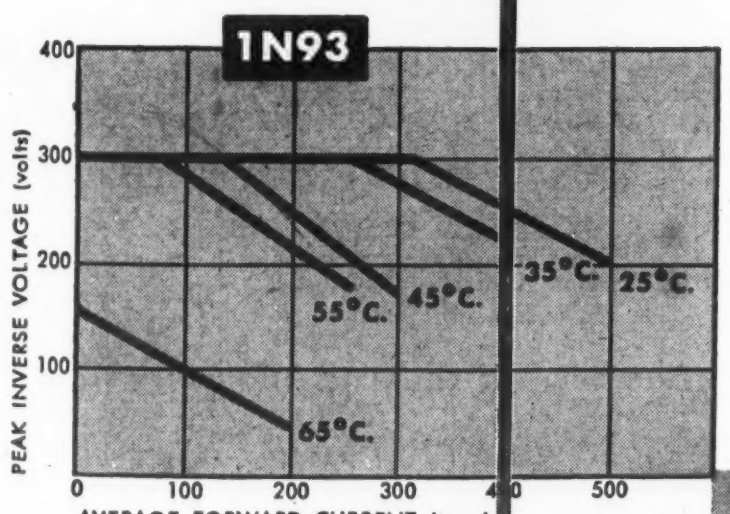
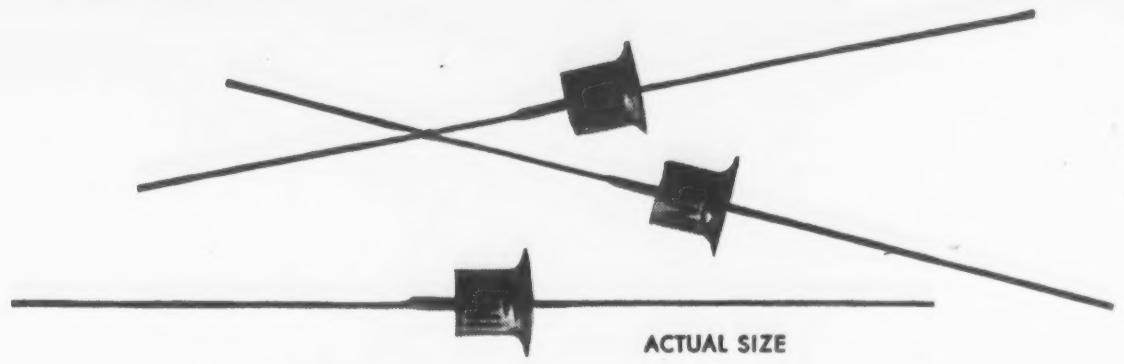




THREE TIMES ACTUAL SIZE





ACTUAL SIZE

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	1N91	1N92	1N93
Peak Inverse Voltage (volts)	100 v. at 2.7 ma	200 v. at 1.9 ma	300 v. at 1.2 ma
Peak Forward Current (amps)	0.47	0.31	0.24
DC Output Current (ma)	150	100	75
DC Surge Current (amps)	25	25	25
Full Load Voltage Drop (volts)	0.5	0.5	0.5
Continuous Reverse Working Voltage (volts)	30	65	100
Operating Frequency (Kc.)	50	50	50
Storage Temperature (°C.)	85	85	85

* ARMED SERVICES and A.E.C. Source Inspection Available

Write for Bulletin PD 5

Inaugurating a new department in SIGNAL

John F. Rider writes our first

GUEST EDITORIAL

It is with a great deal of pleasure that we write these few lines, because we have the opportunity of making a few remarks without having an ax to grind.

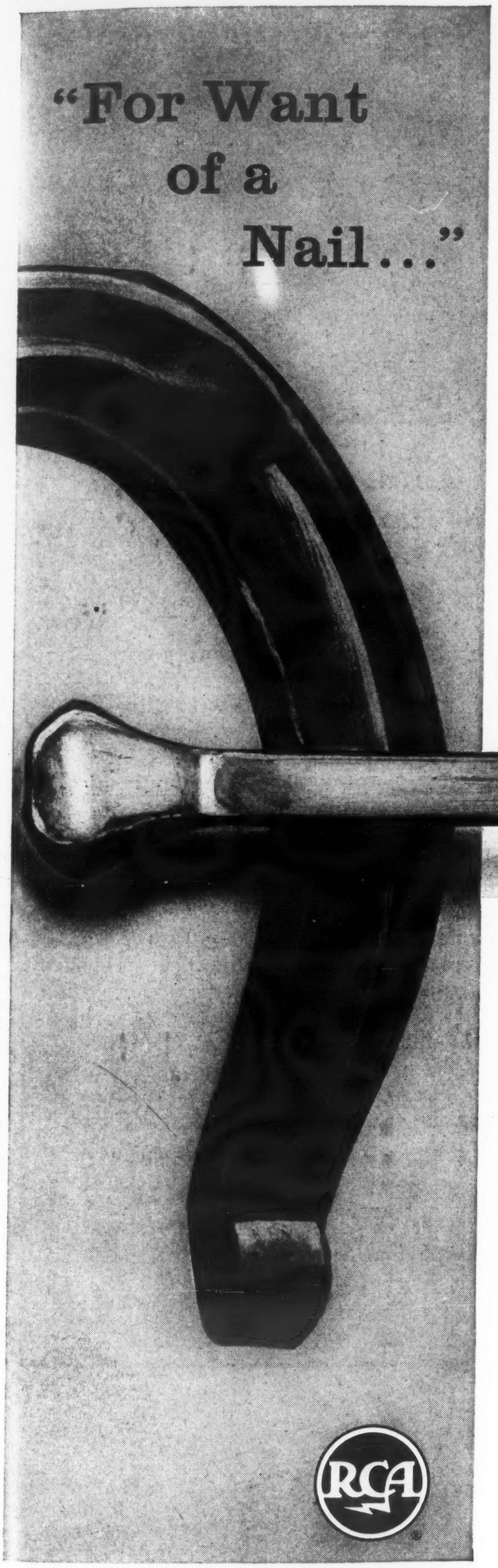
We (in the editorial sense) and many other readers of SIGNAL have been associated with the electronics industry for two decades or more, and with the radio communication art for possibly four decades. It is a well known fact that during all this time, and certainly prior to 1946, electronics was being used in various ways by many branches of the Armed Forces. We recognize that many of the ways in which radio communication was being carried on by the Naval and military forces of the nation could not be disclosed to public view. On the other hand, a great deal of material was not classified; not not only would it have been interesting to learn what our Armed Forces were doing to maintain the defense of the United States, but exposition of the techniques would have been highly informative to those engaged in the utilization of the electronics art.

Many magazines devoted to electronic engineering and to the design of equipment of this kind have been extant for many years. They have done a great deal for the advancement of the art and for the dissemination of vital knowledge required by both designers and practitioners in the field of electronics. But it is only since the birth of SIGNAL that the electronics industry has had the opportunity of gaining some impression of how some of the fabulously intriguing electronic techniques have been put to use by Government agencies.

Being very much concerned with keeping aware of developments in the electronics field, we were very happy to hear (early in 1944) of the concept of what today is the Armed Forces Communications and Electronics Association, and that the Association would have a journal or magazine which would attempt to keep alive the interest in national defense and security through the media of the communications and electronics arts.

The idea of making known, to all who are interested, the accomplishments of the Armed Forces in the field of electronics was very stimulating. We have no hesitancy in saying that, like ourselves, a great many others in the fields of communications and electronics are happy to have seen this come to pass. A dream has become a successful and fruitful reality.

John F. Rider
President
John F. Rider Publisher, Inc.



For want of a nail the shoe is lost,
for want of a shoe the horse is lost,
for want of a horse the rider is lost.

George Herbert's statement applies to electronics today as it did to riders three centuries ago. The point may be illustrated by considering a vital electronic unit made up of thousands of components. If the least of these components fails, the whole unit may fail—and with it a strategic military mission.

The problem of *reliability* is becoming increasingly important as the science of electronics advances. "Black boxes" are hard pressed to perform more complicated tasks with increasing efficiency. And at the same time, the requirements call for smaller dimensions. Notwithstanding environmental extremes of an order hitherto unknown, every resistor, capacitor and relay *must* perform *reliably.* Each "nail" is critical.

That is why RCA is continuing its vigorous search for ways and means to increase the reliability of every component in an electronic unit. This program never ceases. It follows through from design to field evaluation. Everything learned is immediately applied to current development and production.

In seeking a degree of electronic perfection never before attained, RCA joins hands with others in this field. This matter of *reliability* is an industry challenge to be met by ingenuity, brain power and engineering knowledge wherever it is found.

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low-cost "work horse"

for heavy duty jobs

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Overall length, 4"—Width, single pile-up 1¼"—double pile-up 1 7/16"—Height (depending upon the number of springs), Series AQA and ASO 1⅝"; Series ASR and ASA 1⅝"-2".

Four different types

Of Class "A" Relays are available to meet your needs: Series AQA—Quick-Acting, DC; Series ASO—Slow-Operating, DC; Series ASR—Slow-Releasing, DC; and Series ASA—Slow-Acting, DC.

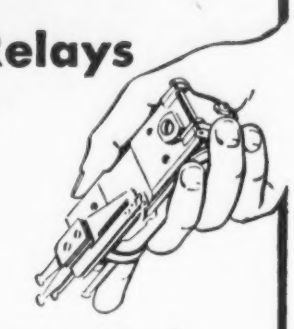
Contacts

Normally single, but can be supplied with twin contacts. Load carrying capacity, 150 watts (maximum 3 amps., non-inductive).

Contact spring capacity

Can be supplied with single or double pile-ups. Series AQA and ASO, 13 springs per pile-up; Series ASR and ASA, 6 springs per pile-up. (More contacts can be accommodated at a sacrifice of operating speed and release time delay.)

Automatic Electric Class "A" Relays are still "healthy" even after 100,000,000 operations!



Here's a relay built for hard work, and every critical point shows it!

Contact points are formed and life-welded to the spring in one operation. An exclusive armature back-stop design prevents armature freezing. A heavy-duty armature bearing is available for unusually heavy spring loads, or constant high-speed use.

Optional "long" or "short" lever armatures offer one lever-ratio for normal operating speeds . . . another for slow-to-release action, permitting a residual gap which holds the required release timing, even under heavy-duty conditions. When extreme conditions suggest added precaution, an armature damper spring may also be supplied to eliminate wear from induced vibration.

For complete details, write for Circular 1800. Automatic Electric Sales Corporation, 1033 West Van Buren Street, Chicago 7, Illinois. In Canada: Automatic Electric Sales (Canada) Ltd., Toronto. *Offices in principal cities.*

RELAYS **SWITCHES**

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CHICAGO

A LETTER FROM STATION CFAC,
CALGARY, ALBERTA

E. C. CONNOR
Technical Director
Broadcast Station CFAC
Calgary, Alberta

AN AMPEX FALLS —AND PROVES ITSELF!

An accidental fall really proved the ruggedness of one of our Ampex 600's. It had had to be located on a narrow shelf four feet above a cement floor in an industrial building. Despite precautions someone pulled on the microphone cable at precisely the wrong moment and the recorder landed on one corner on the floor. The Ampex continued to record, and to the surprise of all concerned, it was impossible to detect the spot on the tape where the machine had fallen off the shelf. The only damage to the recorder was a displaced hold-back tension spring.

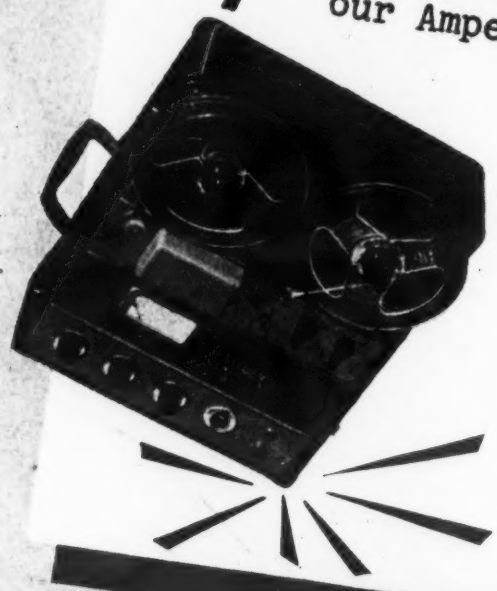
At present we have in service two Ampex 401's, two 403's, two 350's and two 600's. Required servicing has been much less than anticipated, and all are within specifications. To say that we are enthusiastic about the performance of our Ampex recorders could be considered an understatement.

Sincerely,

BROADCAST STATION CFAC

Earle C. Connor.

E. C. Connor
Technical Director



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When the 600 was first developed, Ampex engineers performed a test similar to CFAC's accidental drop—not by accident, but quite intentionally. Also, the Ampex 600 was given running tests equivalent to an estimated 10 years of service. These are reasons why the price you pay for an Ampex buys both the finest performance available and the most hours of service per dollar.

AMPEX

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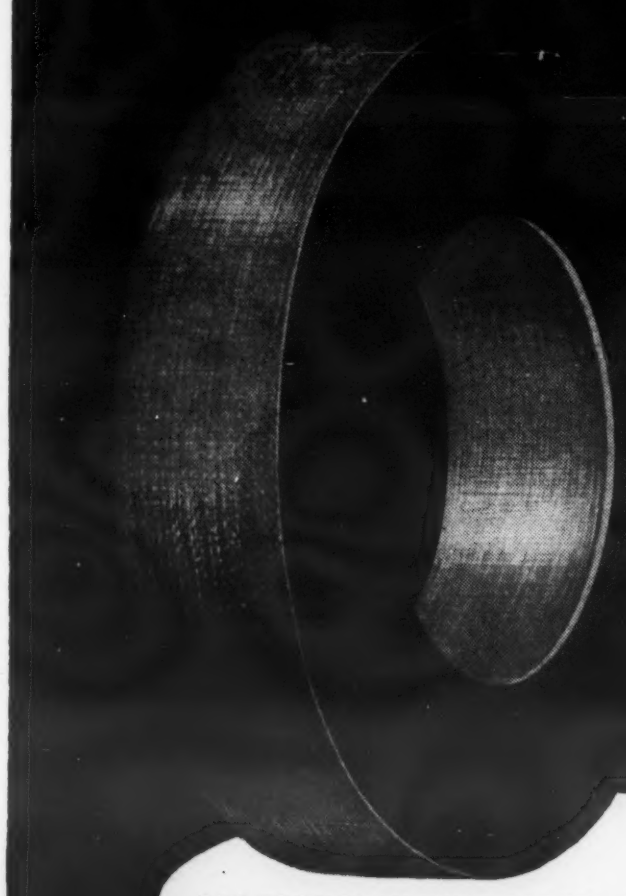

You save, because there can be no waste with the industry's only *Performance-Guaranteed* Tape Wound Cores. You also get the widest choice of standard sizes, and for a slight additional cost can specify your tape wound cores in the remarkable Aluminum Core Box* in any size. For complete details, why not write for your copy of Magnetics, Inc. Catalog TWC-100 today?

MAGNETICS inc.

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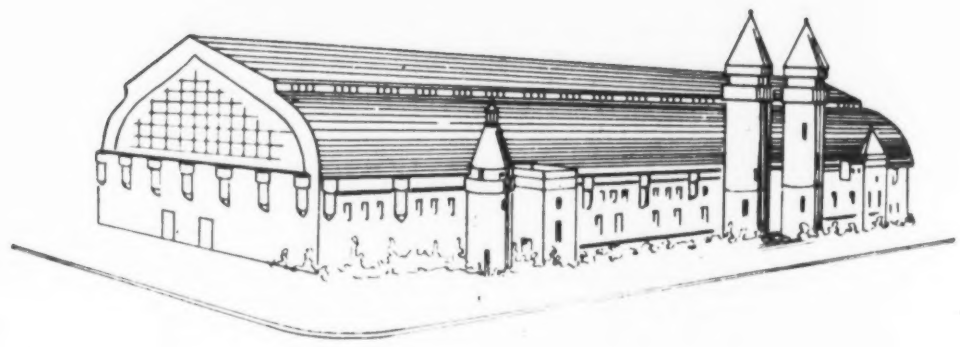
Radio Engineering Show



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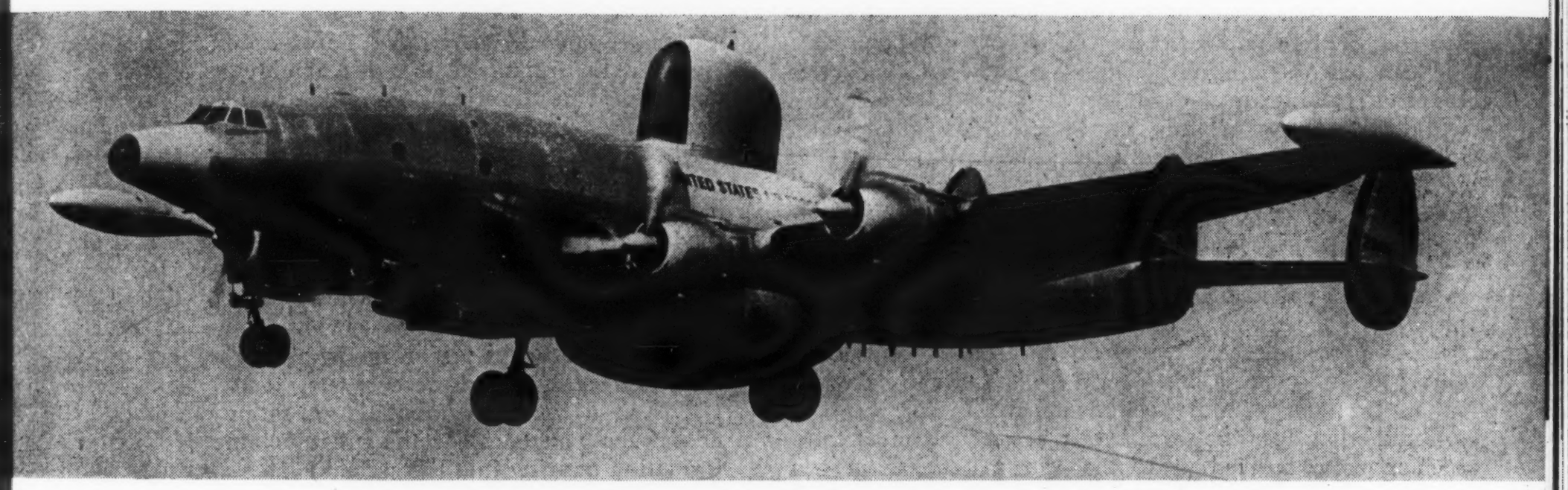
Our New Air SAGE Defense System



Airborne radar coverage over the Atlantic and Pacific Oceans is performed by fleets of RC-121's. Loaded with five tons of radar equipment, these Lockheed Super Constellations are used by the Continental Air Defense Command for airborne early warnings in areas beyond fixed radar locations.

by Major General Gordon A. Blake, USAF
Director of Communications-Electronics, USAF

Modern electronic developments have paved the way for untold numbers of military and commercial advancements. The application of many of these new processes to existing operations has produced automatic and semi-automatic systems which greatly increase their efficiency. Such a system is SAGE. Through specially designed computers and other advanced equipment, our air defense system has been improved to more effectively operate in times of peace and emergency.

This article is taken from a talk given by General Blake at a meeting of the Southern Connecticut Chapter of the Armed Forces Communications and Electronics Association.

SINCE WORLD WAR II, THIS NATION HAS BUILT UP A NEW kind of peacetime economy. It is an economy which devotes over one-half of the Federal budget to military defense. Never before in the nation's long and prosperous history has so much money been devoted to defense in time of peace.

The American taxpayer has borne the high cost of this policy without complaint. The public, however, has an interest in what this cost is buying in terms of our military strength. The Department of Defense would like to report more information to the public more often, but we are frequently restrained by security considerations. The very defense we are all working together to create can be damaged by unwise or untimely releases of information.

One of the prime benefits in publicizing and explaining defense problems is that it helps to secure cooperation from people in all walks of life. In our air defense program, we need cooperation from the average individual citizen, and it is particularly important that the average person take an interest in this system and devote his efforts aggressively to learning his part in it. After all, one of the main purposes of the air defense system is to save the civilian population.

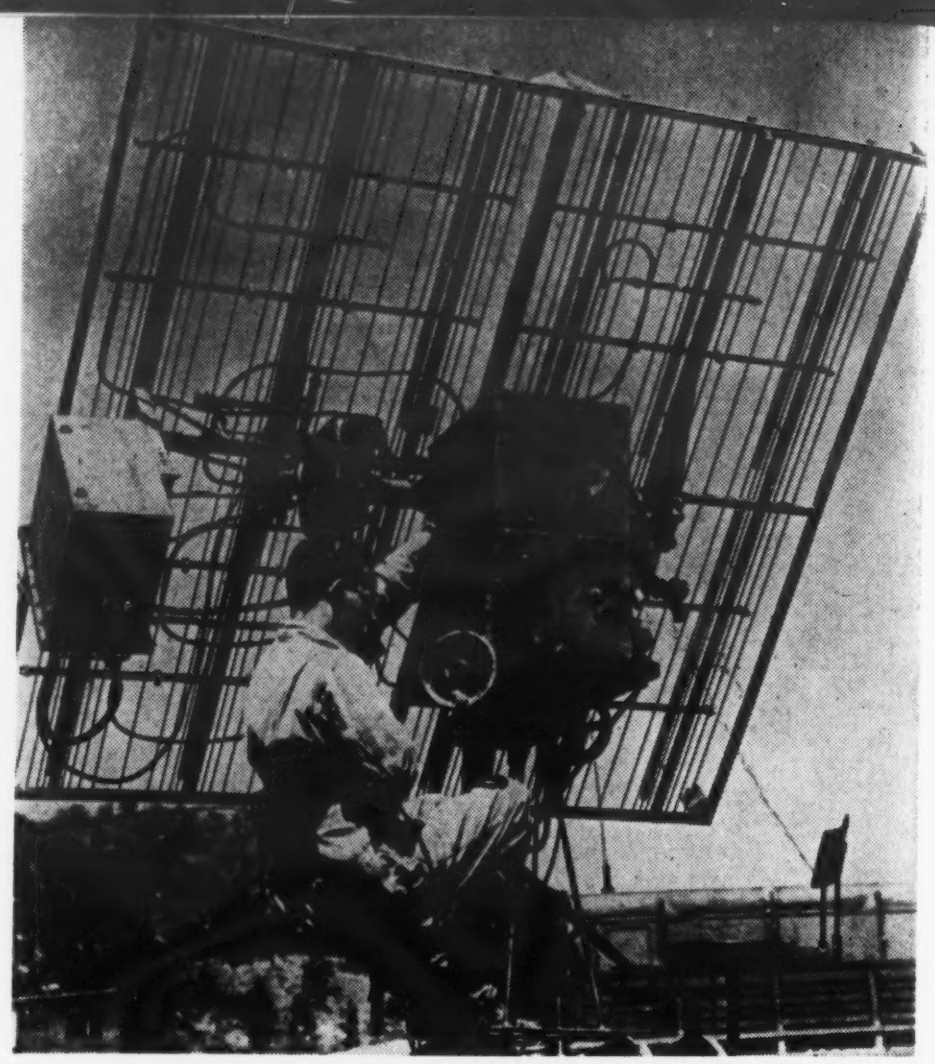
I can tell you a little bit of what the Department of Defense is doing to give you the best air defense in the world. We know that this can be accomplished by making the system as automatic as possible.

Improved Defense by Automatic Methods

A good deal of this automatic operation is wrapped up in a project called SAGE. While this term is not completely strange to many of you, since it has appeared in various press releases, I suspect that some of you may share the misconceptions about SAGE which have resulted from fragmentary comments on the subject.

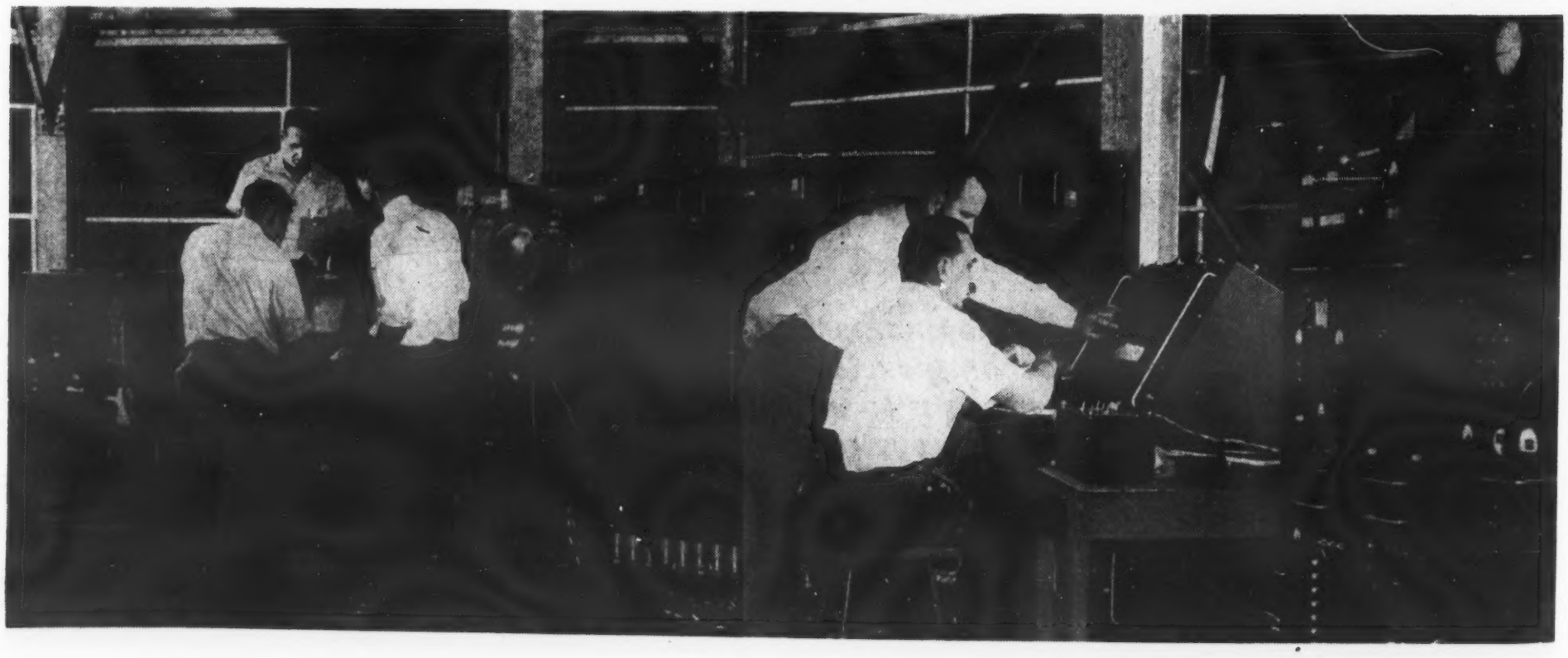
First, what does the word SAGE mean? It is actually a short title derived from the words *Semi-Automatic Ground Environment*. The "Semi-Automatic" part is more or less self explanatory since it relates to the techniques employed to handle information. However, "Ground Environment" is a bit ambiguous. This is a term coined by the Air Force to describe the complex of electronic equipments installed at ground locations and used to provide some sort of operational service. In the case of SAGE the operational service being performed is the handling of large volumes of information or data in solving air defense problems. In short, *SAGE is a project for improving our air defense by applying semi-automatic operation to our handling of information and the direction of weapons.* It is not a new air defense system but rather a major improvement in the one we already have built and are operating today.

The need for semi-automatic operation becomes evident when you consider the great volume of flight information pouring into the system. This over-all volume possibly is as great in peacetime as in wartime. All aircraft flights must be watched and identified by the defense



One of the thirteen sources of information which keep air defense on the alert at any time is the Air Weather Service. Above, an SCR-658, used by the AWS to track Rawinsonde ascents.

Height-finder and search radars work as a team. Information is fed from the radars to a control center (below) in the radome buildings, and is then relayed to fighter bases.



General Electric Co. photo

system. (There are 30,000 scheduled flights per day, plus a great many more unscheduled. Information about these flights is fed to our defense system from 13 sources.) Many of these sources are completely operational. Others are rapidly being developed and expanded.

The first source is the heavy surveillance radars within the United States. The second is the heavy, height-finder radars. Height-finders are necessary because most surveillance radars do not give altitude. Third, there are small gap-filler radars, between the large radars, to cover the gap which large radar equipment cannot see. Fourth, for civil aircraft, flight plans and other information are relayed from the CAA flight service centers, and fifth, for miltary aircraft, similar information is relayed from the Military Flight Service.

Extensive Radar System

The sixth source is the Pine Tree line. This is the name given that part of the United States radar fence which laps over into Canada. Seventh, there are our early warning lines. One is the Mid-Canada line, which extends across Canada from British Columbia to Newfoundland. The other is the DEW line (Distant Early Warning) which extends across the top of Alaska and Canada. (Plans for the Arctic line were the subject of a joint Canadian-American announcement in September, 1954.) Overcoming the rigors of the Arctic to establish the DEW line has been one of the most dramatic accomplishments of the radar extension program. Eighth, there are radars in southern Alaska. Ninth, there are Navy picket ships along the Atlantic and Pacific coasts. These floating radar islands extend the land-based radar coverage for hundreds of miles out to sea.

Number ten, supplementing the coverage at sea, are the Constellation AEW&C aircraft (Airborne Early Warning and Control). These giant aircraft are actually flying radar stations, each carrying five tons of electronic equipment and a crew of 18 men. They greatly expand the "seeing" coverage of the air defense system. AEW&C planes not only patrol a great area, but they can lift radar several miles in the air to scan a much greater line of sight distance.

The eleventh source of information for SAGE is the radar on man-made islands anchored to ocean shoals off the Atlantic seaboard. These are called "Texas Towers" because they resemble oil derricks in the Gulf of Mexico.

The twelfth source of information is the Ground Observer Corps, the GOC. This is made up of thousands of average citizens who volunteer and donate their time to watch the skies a few hours a week. Radar can see through darkness and storm, but human eyes can still pick up essential information that radar cannot. We want to expand the GOC to one million sky watchers at 24,000 locations.

The thirteenth source of information is also important. It is the Air Weather Service. In order to successfully assign and guide weapons, we must know the weather. For example, in order to direct an interception, the computer must know how the wind will affect the speed of both bomber and interceptor.

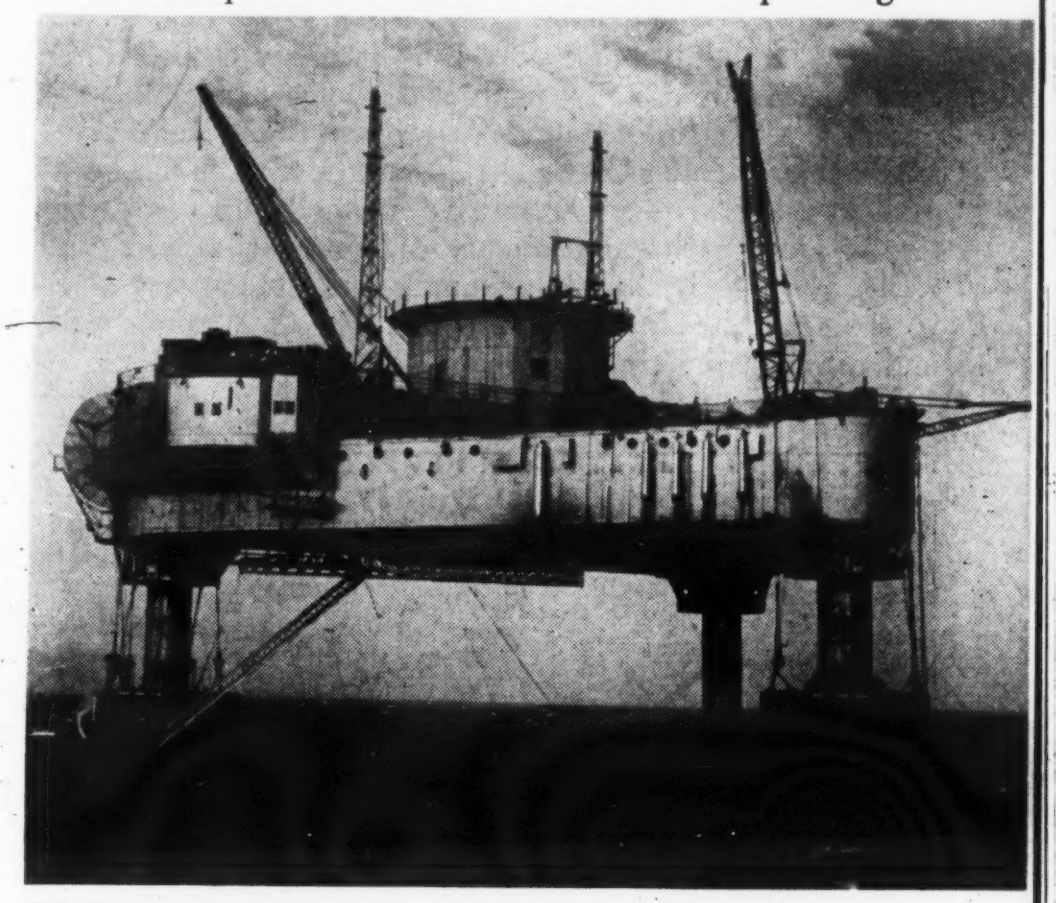
CONAD Responsible for Entire System

The sum total of all data from these 13 sources, pouring into our defense system today, is staggering. And there will be even more when all expansions, now in progress, are completed.

All of this information must be correlated and used by the Continental Air Defense Command. CONAD headquarters, located in Colorado Springs, directs our entire continental air defense. It is a joint command. This means that applicable portions of the Army, Navy, Air Force and Marines have been combined together under one military commander. This gives CONAD direct maximum access to defensive weapons in a maximum number of places. And it provides essential unification of authority, segregation of responsibilities and, consequently, quicker, undelayed striking power.

CONAD has the authority, when an air threat occurs, to order weapons into action. There are Air Force interceptors on alert 24 hours a day, seven days a week. Or CONAD can order interceptions by Navy planes, to the extent of their availability, from carriers or shore stations. Army antiaircraft guns or missiles can be used.

Simultaneously with ordering weapons, CONAD will alert the Federal Civil Defense authorities, the Federal Communications Commission and the Civil Aeronautics Administration. Liaison representatives of each of these agencies are members of the battle staffs at each defense sector headquarters. To insure that civilian planning is complete, up-to-the-minute and feasible, these agencies maintain continuous close contact with activities at CONAD.



Off-shore radar stations—Texas Towers—also implement shore-located radar information. A radar antenna is visible at the left end of the man-made island.

Limitations in Information Handling

To be able to properly exercise such far-reaching authority, CONAD must first process and evaluate all of the air situation data. Whether the system is manual or automatic, flight plans must be compared to radar readings. All air tracks must be numbered. Information as to bearing, distance, height, and speed must be continuously fed to subsector headquarters as the aircraft is tracked. (For air defense the country is divided into subsectors.) After identification as friendly, the information is voice-telephoned to the next subsector. Only when a plane cannot be identified is the information sent on to CONAD Headquarters. Under the manual system, each of these steps is performed by some individual person. The radar operator must read a scope. Another operator plots the progress of flights on a huge plexiglass board. He may receive verbal instructions from a number of sources.

The manual system is so limited that each intercept control station can handle information from only one or two radars. To secure a picture of the air situation over a large area or even a small area, a hand-plotting job must be done at subsector headquarters based on reports from a dozen smaller stations. It is all done on a person-to-person basis.

What SAGE Can Do

Through organization and training, we have made the manual system as efficient as possible. But this is not the answer. Human capabilities are limited.

However, we felt from the very beginning—after putting many scientists to work to study the situation back in 1950—that the problems associated with mass weapons could be overcome. After several years of research, study, and experimentation by top-notch engineers, we believe that most of the problems have actually been solved—and that SAGE is the answer.

The fundamental improvement which semi-automatic operation brings is not only greater speed, but also greater accuracy, reliability and capacity. This could never have been adequately done by manual methods. Under manual operation, the fundamental unit or building block was one radar. Under SAGE, a dozen radars can be automatically linked together to give a much more informative and comprehensive picture of the air situation. As rapidly as the air situation changes, the composite picture in subsector headquarters will change. We can control and direct many times as many weapons as before.

There are many electronic devices which will bring semi-automatic operation to air defense. *The brains of SAGE is the giant electronic computer.* Each sector and subsector will have one. In its memory drums many facts can be stored. As new facts develop, the memory drums can be automatically kept up to date. The computer can furnish, rapidly, solutions to complicated navigational and vectoring problems. *One of its greatest benefits is its unfailing accuracy.*

The Author

General Blake was named Air Force Director of Communications-Electronics in February, 1953. A 1931 graduate of the U. S. Military Academy, he was transferred to the Air Corps in 1933. In 1935, he graduated from the Signal School and has been active in communications work since that time.

General Blake has been a national officer of the AFCEA for almost three years, and presently serves as Third Vice President and on the Executive Committee.

It can furnish a correct picture at the earliest possible moment to the subsector commander. The commander must evaluate the situation and make tactical decisions. Only a computer could assess and evaluate an air situation in relation to location and speed of defense weapons rapidly enough to produce the one best solution.

New Devices Aid System

The semi-automatic operation of SAGE also includes a new converting device which changes radar information into signal form whereby it can be transmitted automatically and carried over class II telephone wires. In the past, the use of telephone wires was limited to voice or teletype. This device also permits radar to function unattended, except for maintenance.

Another automatic feature of SAGE is the data link. The data link is a radio transmitter and receiver. The transmitter is on the ground and the receiver is in the airplane. This will permit the giant computer to automatically transmit weapons control and flight instructions, with all the complex coordinates and numerical readings, to direct the interceptor pilot to the enemy bomber. When an interceptor is equipped with an autopilot, the aircraft itself can be automatically controlled from the ground. Automatic flight control, monitored by the human pilot, is required to meet the demands for accuracy caused by jet speeds.

Need for Communications

Our continental air defense system today is heavily dependent upon communications circuits, to tie together all elements of the continental air defense. SAGE will increase our communications needs. As the speed and complexity of weapons increase, the electronic ground environment required to operate them becomes more complex. And communications is an essential element of this ground environment.

Within the continental United States today we lease almost all point-to-point communications for air defense and for other domestic military operations. Our air defense communications are an integrated network. They originate from each volunteer ground observation post, and they originate from radar stations operated to detect and track aircraft. They run through the complex of direction centers and control centers to the Continental Air Defense Headquarters. This vast web of communications covers the country from coast to coast. It is derived through leasing circuits from the commercial telephone systems of the nation.

Leased Facilities to Continue for SAGE

For a quarter of a century it has been a firm policy of the military service to lease communications lines from domestic commercial telephone companies. This was not always the case, however. We arrived at this policy after years of trial and experimentation with different methods and media. For example, after World War I, the military had embarked on a policy of communications by means of their own radio networks, rather than using telephone circuits. But early in the 1930's two primary reasons influenced the abandonment of that policy. First, the military services found that radio could not provide the same degree of flexibility and diversity of distribution that the domestic telephone commerical carriers could with their extensive land line networks. Such flexibility and diversity could be duplicated by the military only at an exorbitant cost in money and manpower. Second, and equally as important, was the problem of obtaining radio frequencies. They were increasingly needed by the military for overseas communications and for other growing requirements, such as the aeronautical service. Use of radio for domestic communications by the military, therefore, gave way to the leasing of commercial telephone land lines.

To provide the telephone communications required by SAGE will require the local realignment, regrouping and augmentation of the telephone lines now utilized by air defense. But these are only the nerve ends, we might say, in local areas throughout the United States that must be changed and augmented. The backbone of this system remains substantially unaffected.

When the concept of SAGE was developed five years ago, one of the basic assumptions tacitly made by the scientists was that such a system was feasible in the con-

tinental United States only because of the existence of a network of commercial communications land lines that has no counterpart in any other part of the globe. Today this network, operated by the Bell System and the independents, represents a private capital investment of nearly sixteen and a half billion dollars. Since 1945, it has been growing at a rate of one billion dollars a year. The demand from the public for better and more extensive service indicates that this rate of growth will increase, rather than decrease, in the foreseeable future. *As an assistance to national defense, particularly in the air defense aspects, the telephone system is becoming a greater national asset each year.*

We have also estimated that by 1960 it may cost as much as 240 million dollars a year for leasing the communications facilities required for air defense. Normally, this cost of leasing is computed, as it is now for all our leased communications, on the basis of government tariff rates established in the public interest by the FCC and local utilities regulatory bodies. These are applicable to rental of lines by the public in general.

The engineering of leased facilities to insure compatible operation of all elements in the SAGE system is an extremely complex job. Technical standards applicable to all elements must be rigidly adhered to. The entire web of existing communications in a specific local area must be engineered as an integrated whole. Such engineering must be carried out at one point for the entire system, if the system is to operate effectively.

Industrial Cooperation Imperative for Success

This focal point is the engineering department of the American Telephone & Telegraph Company in New York City. Participating in this effort are representatives of the associated Bell companies and a representative of the U.S. Independent Telephone Association. We are also encouraging coordination with manufacturers who make equipment for the independent companies.

As the engineering for each area is completed, the installation and operation of the required leased facilities will be carried out by local telephone companies in the areas in which SAGE direction and control centers are established. All companies, associated Bell and Independents, will have an opportunity to provide the leased circuitry required for SAGE.

At present, the Air Force is leasing lines for all military purposes from about 600 telephone companies, 20 of which are Bell System and 580 are independents. For SAGE, nearly every corner of the country will be involved. Obviously, a great many telephone companies will participate. The number of companies participating cannot be predicted at this juncture. However, all the telephone companies of the nation are protected by franchises covering the areas they serve. Any company affected by SAGE will, therefore, have an opportunity to provide circuits required in its area. A waiver in favor of another company can be made only if the franchise holder volunteers it.

One last word about leased communications. I would like to stress that the communications lines required for SAGE will, in general, not be newly constructed in their entirety. The major portion will be derived from the vast network of commercial communications lines presently in existence. The value of these new extensions lies in the fact that they will be engineered and built to integrate with the over-all telephone system of the country. Only by this can we get the quality, flexibility and reliability of service required.

I would also like to stress that we are counting on teamwork and support of this program from all parts of our vast telephone system, including the many equipment manufacturers which serve that system. Our experiences in the past indicate clearly that such teamwork will be readily available. Also our specific discussions with both Bell System people and representatives of the Independent Telephone Association indicate that the service we need for SAGE will be provided.

A Specific Definition of SAGE

Before turning to our program for implementing SAGE, I would like now to give you the specific definition of this project as we use it in our daily work.

The SAGE System is that portion of the air defense system that provides the means for the semi-automatic processing of data and weapon control. It consists of:

a. Facilities to transmit air-surveillance data from data-gathering sources to direction centers.

b. Direction centers, where air-surveillance data is evaluated and developed into air situations, and from which weapons assignment and guidance is generated.

c. Facilities to transmit situation data from direction centers to combat centers.

d. Combat centers, where data is evaluated and developed into broad sector situations, from which weapons resources can be monitored.

e. Facilities to transmit instructions from combat centers to direction centers.

f. Facilities to transmit the instructions from direction centers to users such as CAA, FCDA, and various units.

You can see that the heart of the SAGE project is the direction center building which houses the computer and the "black boxes" which feed information to it. A second major part of SAGE is the leased communications circuits which connect the rest of the air defense activities to the computer building. The third, and much smaller part of the project, is the equipment at the radar or other sites which converts the raw data into a form which the leased circuits can handle.

The equipment at each subsector for the most part will be housed in a concrete blockhouse building, which must

The huge antenna used with a radar height-finder needs a room all its own above the control center is the radome building erected in Arctic climates. Arctic stations are part of our early warning system.

General Electric Co. photo

all be especially constructed for this purpose. It will be windowless, must be air-conditioned for technical reasons, and have special heat-dissipation equipment. It must have special lighting and special dehumidifiers. Each blockhouse will cost about $3½ million. In addition, each one must have an ancillary power building. The power building, however, will not have the technical requirements of the main building and will cost much less.

Our biggest problem in SAGE, next to devising and testing the system itself, is the problem of successfully building, engineering and installing the equipment. A basic requirement, of course, is that the finished product will have a high level of operational reliability.

There are several types of complex electronic equipment in SAGE. Three have already been mentioned—the computer, the radar converter and the data link. There also is the monitoring equipment which continuously checks on unattended radar miles and miles away to see that it is functioning properly. At the radar sites, special equipment will automatically transmit the converted radar data over telephone lines. And there are many other lesser equipments both at the radar site and at the control center. The coordination of these equipments is a major engineering feat.

Watching the radar set for unidentified planes is the job of airmen in Aircraft Warning Squadrons. The above picture was taken at Montauk Air Force Station, Long Island, New York.

The Air Force has been confronted with similar tasks in our aircraft and missile programs. As many of you already know, we have solved them by applying what we call weapons systems management. This type of management uses a major contractor to coordinate and integrate the engineering and production details of the complete aircraft or missile. For example, we have used this method in the B-52 with Boeing as the systems contractor. For SAGE, the contractor is the Western Electric Company. However, it is really the total resources of the Bell System we are hiring for this purpose—Western Electric is merely the contracting agent as is the case customarily in contracts involving the Bell System.

Now, using a weapons system contractor does not mean that other companies do not take part in the program. Actually, the major items of equipment, which dollar-wise represent the most significant portion of the SAGE system, are procured from several other manufacturers on prime Air Force contracts. In addition to this, many, many subcontractors share in the job of building equipment for SAGE. A good proportion of these subcontractors fall into the category of small business.

The large task of erecting the specialized building for the computer will be contracted, in most cases, with local construction companies under bidding procedures normally used for Air Force construction. From a purely financial point of view, it is wrong to assume that the weapons system contractor for SAGE gets a lion's share of the business. Specifically, for management services, the weapons system contractor will receive only a very minor percent of the total cost.

On the Air Force side, the SAGE project is managed by a Joint Project Office, just as we do for aircraft projects. This office is set up in New York City and is the focal point for management of the task of building the SAGE direction centers. The Air Materiel Command exercises command control over this JPO; however, representatives of the Air Research and Development Command are full time members of the JPO staff. Other agencies having a vital interest in SAGE, such as CONAD and our Air Force installations representatives, are represented by full time liaison officers.

The management provided by our JPO is not just passive monitoring of the prime contractor's work. It is, instead, a very active daily control of the salient points in the project. Our main purpose in using the weapons system contractor is to provide the over-all integration needed in complex engineering jobs. However, we recognize the Air Force's responsibility for insuring that our equipment procurements are operationally useful and obtained economically. So we provide the controls necessary for this in the JPO.

One aspect of SAGE is frequently misunderstood. Although we are leasing the communications circuits for SAGE, we are not leasing the other parts of SAGE. When the direction center buildings, with their computers and other equipment, are completed, they will be U. S. Government property.

Weapons System Management

Let me emphasize, in closing, that SAGE actually is not a new air defense system. It is merely the modernizing of our existing system by introducing semi-automatic operation. This is accomplished by many electronic devices, by far the largest and most complex being the electronic computer. This computer is of such a nature that a special building with special atmospheric conditions is necessary for its adequate functioning. This building, including installed equipment, will be U. S. Government property. Over 600 separate communications lines must enter this building, tying it to many radars, to many other information sources, and to other control centers. These communications circuits will be leased from the appropriate franchise holder.

Constructing the SAGE system is one of the largest electronic ground systems we have ever attempted. The Air Force, in order to control it, has selected the weapons system type of management. This type of management has already proven successful in our aircraft and missile programs. This is the first time it has been applied to a ground system. We are confident that this approach will give this country a reliable, major improvement in our air defense. And it will do it in the shortest possible time, at a minimum cost for quality workmanship.

Reprints of this article are available by writing to SIGNAL *magazine, 1624 Eye Street, N. W., Washington 6, D. C. Cost is $.20 each.*

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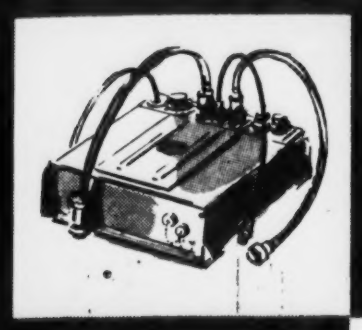

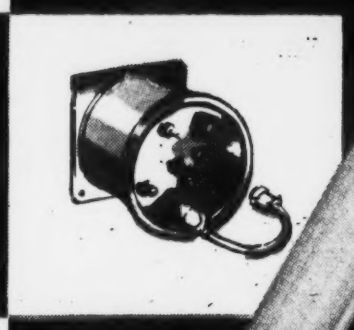

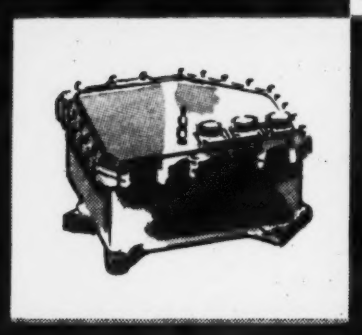

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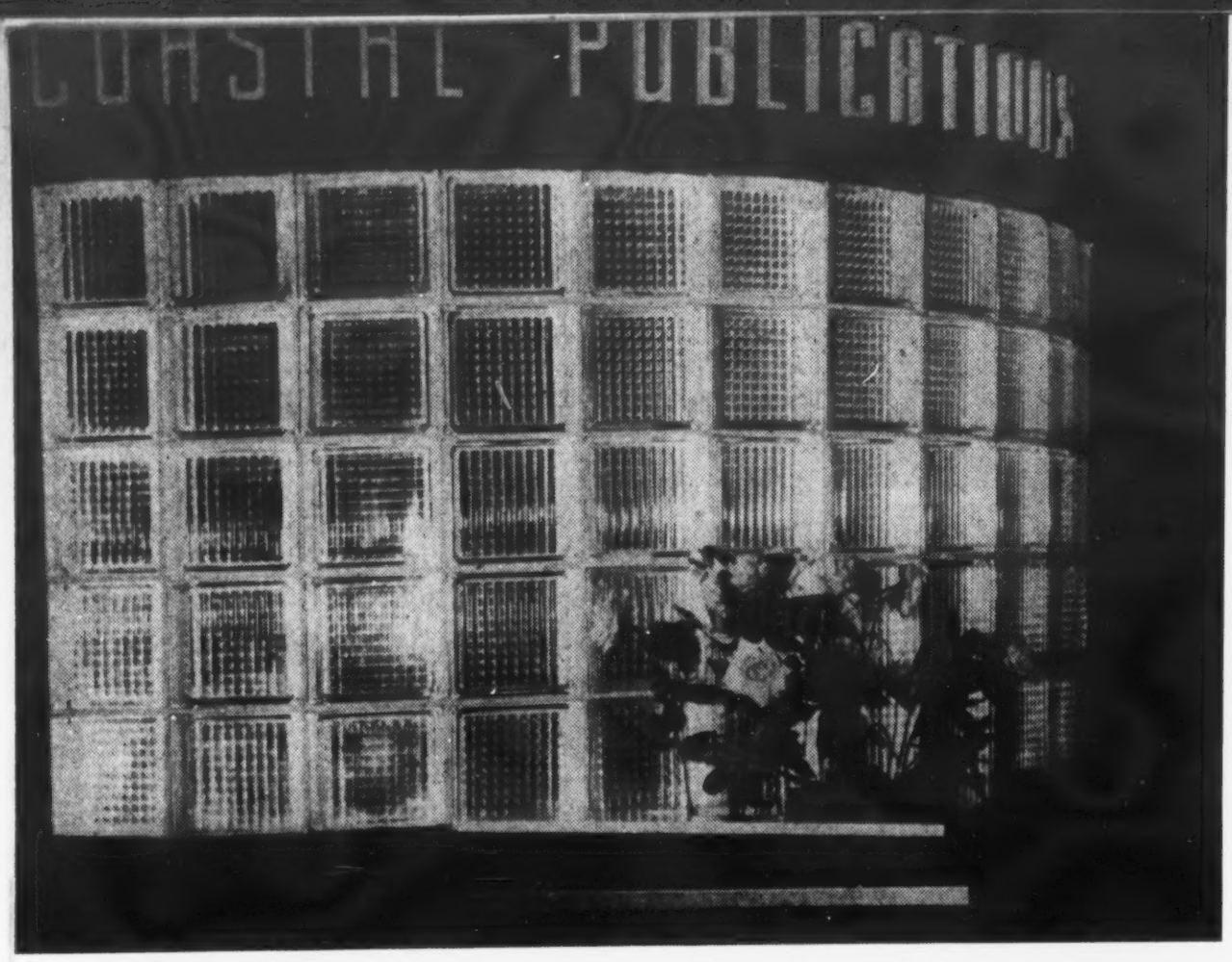


Main entrance to the Coastal Publications Corporation offices in New York City.

Successful Technical Publications

by J. A. Bolander
President
Coastal Publications Corporation

THE EMPHASIS TODAY IS ON SERVICE SPECIALIZATION. ONE of the relatively new successful businesses firmly established in this country is the organization that specializes in the preparation of technical literature to Government specifications, commonly referred to as technical publications firms.

As with any service-type organization, the success of the technical publication firm is based on the need for the service, but the *degree* of success is determined by the policy of the firm.

The need for the service is clearly established. Manufacturers, when asked why they prefer to let an outside firm handle their technical literature, give these typical replies.

". . . . . We are manufacturers of electronic equipment, not writers or illustrators; we think it is good business to let an organization with trained personnel who make it their business to handle this type of problem take care of our literature requirements. . . . ."

". . . . . We hired our engineers to develop equipment, not to write handbooks. . . . ."

". . . . . We found a firm that helps prepare our bids and insures us a profit on our handbooks. Why should we get involved. . . . ."

". . . . . Our literature requirements fluctuate too much to maintain a staff of skilled writers and illustrators. We save money by contracting our requirements, as they occur, to a technical publications firm. . . . ."

". . . . .Payments for the Government equipment we manufacture are contingent on approval of the accompanying instruction manuals . . . . . it has been our experience that most technical publications firms can complete the work in less time, produce better handbooks, and will accept the responsibility for Government approval of their work. . . . ."

Nine Point Program

There is little doubt about the need for a service for the preparation of technical publications. There are approximately two hundred Government specifications applicable to the preparation of technical literature today. Most of the specifications contain instructions for reference to other specifications and many are subject to various interpretations. It is small wonder that the manufacturers, who are increasingly faced with the task of developing more complicated equipment, are relieved to find a service organization that will assume responsibility for the preparation of parts catalogs, operation,

Double editorial checking of copy is standard practice at Coastal.

service, and overhaul manuals, and the many other publications necessary for proper operation and maintenance of their equipment.

The degree of success of the technical publications firms is determined by their policy. Of course, policy is a broad term, but most of the important factors contributing to a successful operation are actually matters of policy which are either approved or disapproved by management. Practically all the policies of Coastal Publications Corporation are formulated with one thought in mind . . . *better service to the client.* We are always searching for opportunities to help the client, over and above our contractual obligations to furnish approved technical literature.

Some of the policies Coastal has established are as follows:

1. *Assistance in Preparing Bids.* In many cases we have made it possible for clients to profit from their handbook requirements by assisting in the preparation of bids. Because of inexperience in handbook preparation or misunderstanding of Government specification requirements, many manufacturers lose money on this phase of their contracts.

2. *Engineering Suggestions.* Our writers' research often brings to light methods of improving the operation

Coastal maintains close quality control with modern photographic and darkroom facilities.

or function of our clients' equipment. We have suggested and designed test equipment for clients who have had difficulty in finding the solution to various test problems. However, it is Coastal's policy to offer these suggestions only if the client expresses the desire for us to do so.

3. *Adequate Liaison.* It is Coastal's policy to have liaison engineer-writers available for immediate consultation, regardless of the scope or nature of the problem in question.

4. *Employee-employer Relationship.* This is a very important factor for insuring the success of any business, but in the technical publications field it is imperative that a harmonious climate be established and maintained. Under the pressure of meeting deadlines, complying with constantly changing specifications, engineering changes, etc., the emotional stability of the most poised individual is severely tested. If the policy of the firm toward its employees is not one of complete fairness, the service to the client will suffer in direct proportion to the employees' discontent; there will be rapid turnover of personnel and the resulting problem of untrained technicians.

5. *Screening of Applicants.* The problem of securing and keeping trained technicians at Coastal has been further reduced by the policy of carefully screening all applicants. We first ascertain that the applicants are qualified technically for the position, and then we screen them to determine their ability to work with other people. If applicants meet these requirements for employment, they are paid salaries commensurate with their abilities, given comfortable working quarters, and a sincere effort is made by management to assist them with any problems they may have at any time.

6. *Financial Stability.* Inadequate financial reserve is one of the common causes for failure in the technical publications field. At Coastal, an adequate reserve is maintained at all times to insure payroll and other expenses, regardless of the size of the contract, completion date, or method of payment. As a further service to our clients, or prospective clients, we offer to post performance bonds equal to the contract price as a guarantee of our ability to meet delivery schedules or acceptance of work completed.

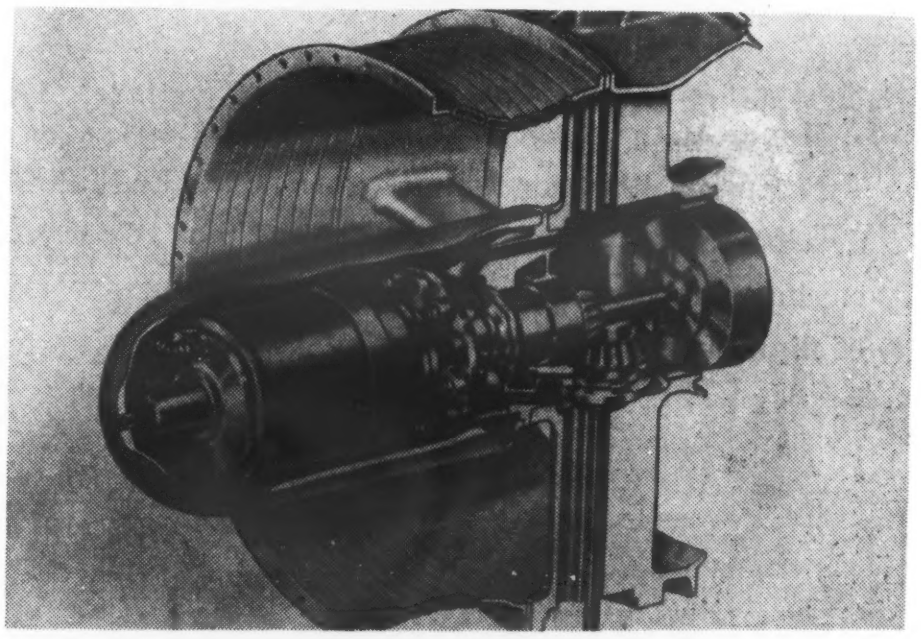
7. *Balanced Advertising and Sales.* A sound policy of advertising and an adequate sales force in the field is essential for success in the technical publications field. A sales engineer who can "double-in-brass" as a qualified consultant or, if necessary, as an engineer-writer, can render an invaluable service to both his firm and the client.

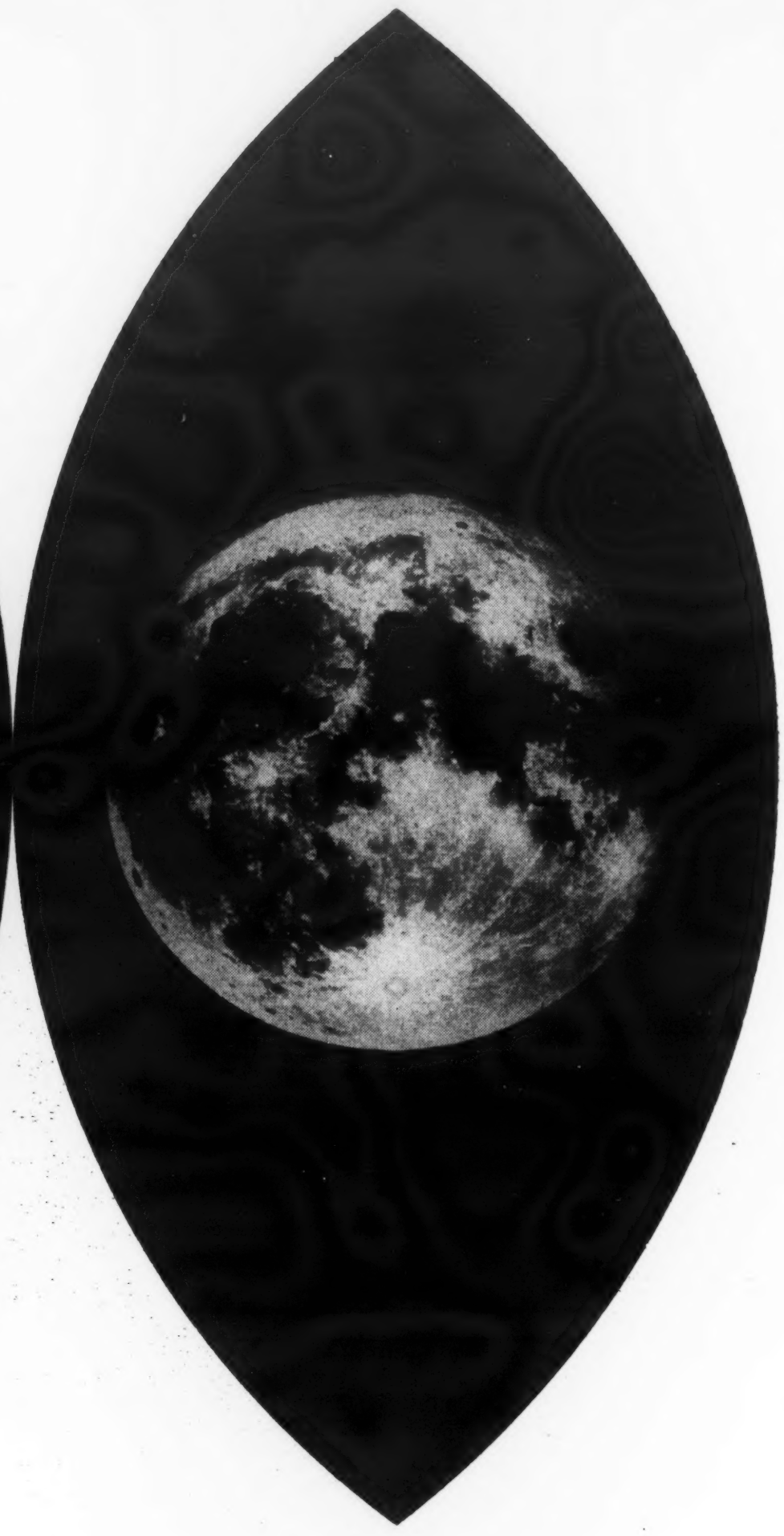
8. *Relationship with Government Services.* Keeping abreast of the latest changes in policy, specifications, and procedures of the various Government agencies must be a policy of any technical publications firm that wants to render a complete service to its clients. This can be done by a policy of constant contact with the various agencies (who appreciate interest in their problems) and a cooperative attitude in working relationship.

9. *Meeting Delivery Schedules.* There should be no question about the policy of any technical publications firm regarding this requirement. However, some firms still operate on the basis of "promise anything to get the job; deliver—if and when we can." At Coastal, the delivery deadline is a serious consideration, and no promise is made regarding the meeting of deadlines unless we are firmly convinced that it is possible to do so, and, at the same time, maintain our high standard of quality. Repeat business and continued success depends largely on how a firm meets the responsibility of committed delivery schedules.

The need for reliable technical publications services is growing day by day, and a sound policy, as outlined, will insure the success of this highly specialized business.

Example of the type of illustrations used in technical handbooks prepared by Coastal.





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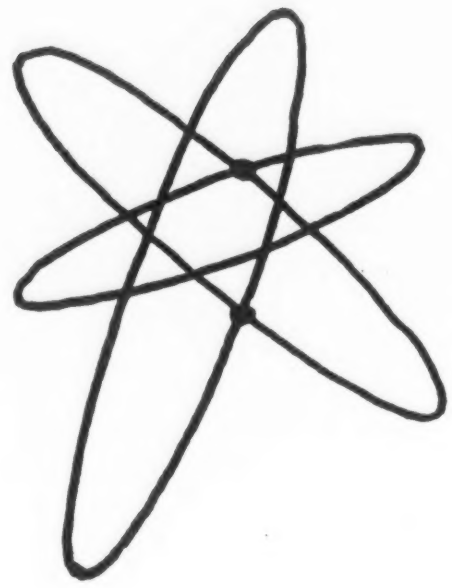
ELECTRONICS in Nuclear Power Plants



by

- ***J. C. Grigg***
  Reactor Control Branch
  Nuclear Power Division, BuShips
  Department of the Navy
- ***J. Larsen***
  Electronics Division, BuShips
  Department of the Navy
- ***Commander J. G. Wallace, USN***
  Electronics Division, BuShips
  Department of the Navy

THE ROLE OF ELECTRONICS IN nuclear power plants is based chiefly on its use in detecting and measuring nuclear radiation. Electronic circuits are also required to respond quickly to variations in radiation, and to present an accurate picture of conditions on meters or recording instruments, or to actuate controls and alarms.

Neutrons and Gamma Rays

The radiation of primary concern present in a nuclear power plant consists of two main components—neutrons and gamma rays. Electronic means are used to measure the neutron density or flux which is the major factor in determining the power being generated in the reactor. Electronics is also used to detect excessive gamma and neutron radiation which indicates plant malfunctioning or presents a hazard to operating personnel. The conduct of experiments in nuclear physics and chemistry leading to the design of reactors is also dependent upon the ability of electronics to detect and measure radiation.

A little known but extremely important contribution electronics is making to nuclear power may also be found in the vital part that digital and analog computers are playing in reactor design and in the analysis of nuclear power plant operations. Finally, there are electronic techniques that show some promise in the measurements of key reactor plant parameters, such as temperature, pressure, flow and level indication.

Most nuclear reactors utilize three or more ranges of nuclear instruments to determine the amount of power being generated. As an example, the following can be considered typical:

(a) Instruments to monitor the approach to and through criticality (point at which the reactor can sustain a chain reaction) during start-up, called the source range;

(b) Instruments to monitor the intermediate range between the source range and the power range;

(c) Instruments to monitor the power range. In terms of power, this may represent a transition from milliwatts to megawatts.

Since the power generated by a reactor is proportional to the number of neutrons emitted within the core, it is possible, by electronic techniques, to measure power throughout the three ranges. In naval nuclear power plants, power is measured and controlled primarily by other means, such as temperature and flow in the power range and only secondarily by flux measurements. But the measurement of reactor power in the start-up and intermediate ranges requires sensitivity presently attainable only with electron tube amplifiers.

Instrumentation

In addition to the measurement of power, electronic equipment measures the "period" of the reactor, the "period" being defined as the time interval in which the reactor changes power level by a factor of e, or 2.718. This factor is important because it is a direct indication as to whether or not the reactor is increasing (or decreasing) power at a safe rate.

The nuclear instrumentation consists of separate channels to cover

each of the above ranges. The range of each channel, with suitable overlap to give continuity of indication, is established by the limitations of the type of detector used for that range. At present, with practical detectors located outside the core, there is no detector sensitive enough to measure neutron flux as low as the natural fission rate of the uranium in the reactor, and to discriminate between this measurement and spurious celestial radiation or electronic "noise." The natural fission rate prior to reaching criticality, is about 10^{-18} times full power level. To permit a safe approach to criticality during start-up, therefore, it is necessary to use an additional "source," say of polonium beryllium, to bring power level up to about one fourth watt so that present electronic detectors in the start-up range may be used to obtain a reading prior to bringing the reactor to criticality. Power level may then be increased at a safe rate.

The types of neutron detectors commonly used are: (a) proportional or fission counters for the source range; (b) compensated ion chambers for the intermediate range; and (c) the uncompensated ion chambers for the power range. These are followed by electronic circuits the purposes of which are to amplify the signal, to convert the counts caused by pulses, to respond quickly to variations in flux, to present usable data on meters and to provide signals for the control of the reactor. One of the most common of these circuits is the pulse amplifier, which amplifies the extremely small voltage signal (few tenths of a millivolt) given off by the detector up to the required level for discrimination.

Logarithmic Amplifier

It is possible that a reactor may rise in power by a factor of hundreds or thousands in a short period of time. If allowed to do so undetected at low levels, the reactor might burn out by surging through the normal power range too rapidly. During normal start-up, for example, the power level is raised from a level in watts up to millions of watts. A meter with a linear scale could not cover this wide variation with the same sensitivity. In addition, it is extremely desirable to know the rate by which the power of the reactor is increasing (or decreasing) so that it may be operated safely. In order to provide the above information, an electronic circuit, a logarithmic amplifier, is used. The heart of this circuit is a vacuum tube whose output is proportional to the logarithm of the input current. If this circuit is followed by a differentiating circuit which will give the time derivative of the log of the current, the result will be the "period" of the reactor. Knowledge of the period is a good index of how safely the reactor is being operated.

Reactor Coolant System

It was mentioned previously that power level is measured and controlled primarily by means other than electronics in the power range. The parameters used are temperature, pressure, and flow. The primary coolant conducts heat from the reactor to make steam to drive the turbines that provide the power for end use. Temperature is measured with thermocouples and resistance thermometers; pressure and flow by differential-pressure cells. These detectors may be used with conventional pneumatic or magnetic amplifier controller techniques. Electronic techniques are not generally required for amplification and computation.

Because of faster response times, greater sensitivity and high accuracy potential, electronic techniques show promise in the measure of flow and temperature directly. For example, an ultra-sonic flow-meter is presently under development which may, as a by-product, give accurate temperature measurement as well. It is also considered quite possible that electronic techniques may yield better methods of measuring level, detection of leaks, and determining machinery hot spots, if the required reliability can be met.

The overall control system for nuclear power plants is composed of a combination of electronic and non-electronic systems, one supplementing the other in a manner contributing to the highest efficiency and safety of the plant. Typically, the automatic control system and the reactor protective system make judicious use of electronic and non-electronic sub-assemblies. In the reactor protective system, for example, a sharp rise in neutron flux detected by an electronic instrument actuates mechanisms which cause the control rods to automatically shut down the reactor to prevent damage to the core.

Radiation Monitoring

That faculty of electronics to detect and measure radiation is also used to protect personnel who operate the plant or who perform their duties in close proximity to the plant. It also permits early warning in some cases, of a casualty to the power plant and thereby permits early corrective action. The radiation monitoring equipment used may be fixed, portable, or personnel monitoring devices.

The fixed radiation monitoring equipment is that which is operated continuously, and located permanently, at locations about the reactor most susceptible to radiation. It has the two-fold function of: first, monitoring the power plant operation for malfunctioning, and secondly, providing early warning to personnel of excessive radiation. This equipment consists of three types of monitors: (a) gamma monitors, which detect excessive gamma radiation caused by loss of shielding, by activity of greater intensity than was provided for by shielding, or by presence of primary coolant (which is highly radioactive) or other radioactive material where shielding is not provided; (b) neutron monitors, which detect an excessive neutron field that may be caused by loss or reduction of shielding; and (c) air particle detectors, which detect radioactive airborne particles, such as dust, resulting from escape of primary coolant or other radioactive material to the

(*Continued on page* 45, *col.* 4)

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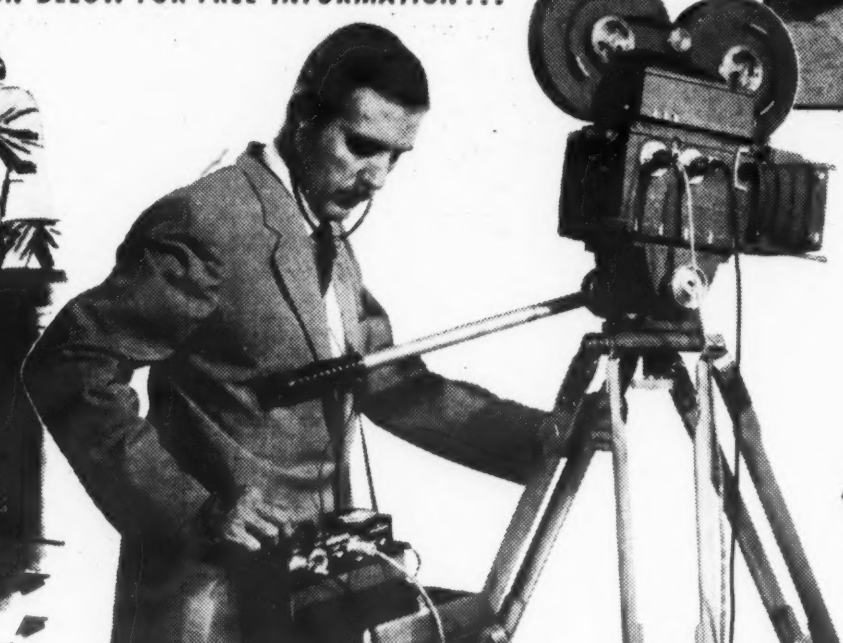

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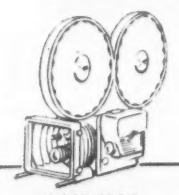

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PLAN NOW TO ATTEND

Combined Arms Instruction at The Signal School

by Lieutenant Colonel Oscar C. Buser, SigC
Secretary, The Signal School
Fort Monmouth, New Jersey

NO ONE HAS EVER DENIED THE importance of communications to the successful accomplishment of a military mission. It is truly the VOICE OF COMMAND. Conversely, it is equally important that the communicator understand and appreciate the complexity of modern warfare and the problems that confront the tactical commander. The mutual understanding of the problems confronting each assists in the establishment of a better understanding and consequently in a more efficient solution to the many problems that arise.

Senior Signal Corps officers, attending the Advanced Officer Course at The Signal School, Fort Monmouth, New Jersey, are being given background in the employment of combined arms to increase their ability to solve the communications problems that arise when they are supporting their sister combat arms. Resident instructors from the Air Force, Infantry, Armored Force and Artillery, together with Signal Corps officers qualified in Airborne, Amphibious and other specialized types of operations, conduct instruction in both the theoretical as well as the practical application of their respective tactics.

Maj. Richard F. Heske, Infantry instructor, use a terrain board to instruct Signal School students in infantry small unit tactics. Looking on are: (l to r) Lt. Robert A. Wahrman; Lt. Arthur B. Whittemore; Lt. Robert F. Young, and Lt. Marvin C. Turow.

Infantry Part

Infantry officers assigned to the Officers' Department of The Signal School bring to Signal officers up-to-date tactics and techniques of infantry operations. Capabilities and limitations of infantry weapons are demonstrated and the tactical employment of various units from Battalion to Army size is presented. Signal officers are required to solve map exercises and to defend their solutions before their classmates.

In addition to their tactical instruction, infantry instructors are responsible for instruction in the principles of staff operation, the duties and functions of the various members of the staff, and the records and reports required within a staff section. Practical exercises are numerous and are used to familiarize the student with all aspects of infantry operations and staff planning. The student officer, while not qualifying as an infantry officer, receives sufficient instruction to enable him to properly evaluate a situation and to anticipate the communications that will be required in support of infantry operations.

Armor Instruction

The Armor instructor indoctrinates student officers in the decisive role Armor plays on today's battlefield. The overall organization and the principles of employment of armored units, including the Armored Division, the Armored Cavalry Regiment, the Armor Group, and armored

units organic to the Infantry Division, are presented. Instruction for the Advanced Officer classes is at division and combat command level. Approximately one-third of the armor instruction is presented by conference techniques and the remaining two-thirds by practical exercises which cover both offensive and defensive operations.

The dependence of successful armor operations on communications is constantly stressed. The practical exercises provide student officers with the background in armor tactics necessary for an understanding of the employment of mobility, fire power and shock action of Armor in combat.

Lt. Col. Henry M. Renfro, senior Artillery officers at the Signal School, instructs a class in light artillery equipment. Above, he demonstrates a 105 mm Howitzer M2A.

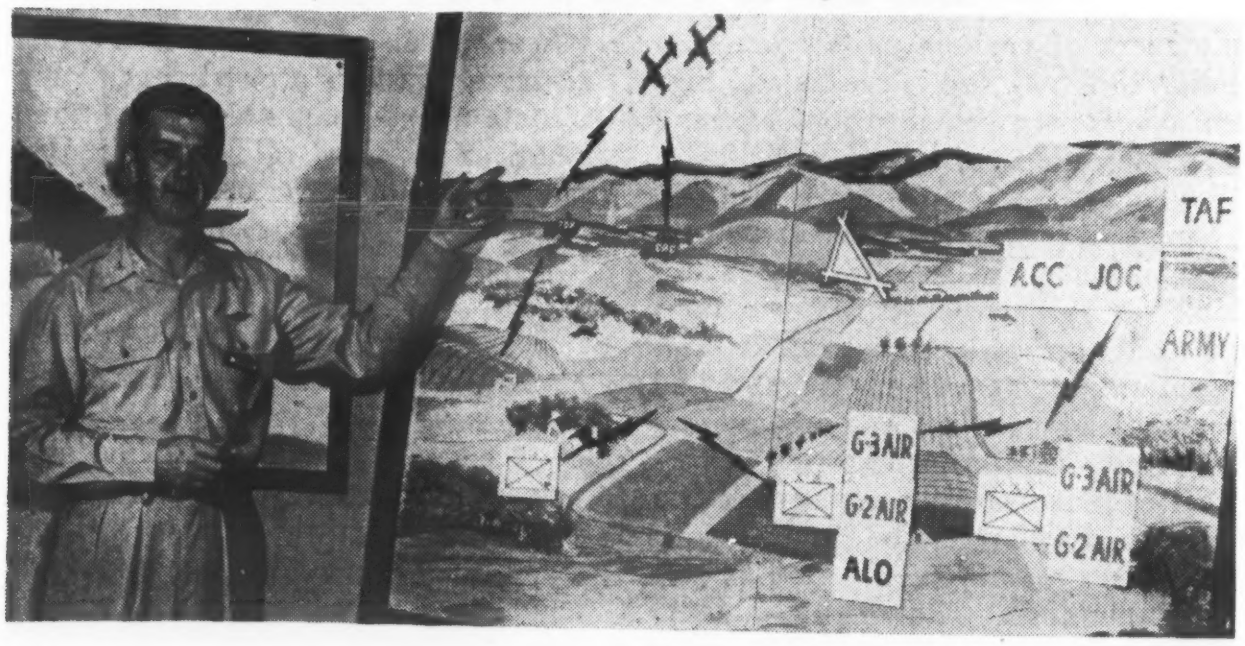
Artillery and Air Force

The Artillery has always been one of the greatest users of communications. With the advent of guided missiles and other means of delivering atomic firepower in support of ground forces, the importance of communications becomes greater. It is natural, therefore, that the Signal officer should have as part of his instruction a comprehensive course in the employment of all types of artillery support.

The Artillery representative presents to the student officer, not only the organization, capabilities and limitations of conventional weapons, but includes in his program instruction in the tactical employment of guided missiles and 280mm gun battalions. Throughout the entire instruction, the supporting role of the artillery on the field of battle and in the air defense of our nation is stressed. As in the other combat arms, map exercises serve as a media to impress upon the student officer the principles of artillery employment and support.

The Air Force role is presented in support of ground operations with particular stress placed upon the integrated tactical air support of ground operations, including the operations and functions of the Joint Operations Center. Students are familiarized with the capabilities and limitations of strategic air operations, air defense and air transported operations. The instruction includes presentations of the organization of the Air Force and the various commands comprising its world-wide forces. Several field trips to nearby Air Force installations are included in the air program, so that students have an opportunity to observe the actual operation of radar equipment, navigational aids, operating techniques and communication facilities. They witness the alert procedures of a fighter-interceptor base and have demonstrated to them the facilities that enable defensive actions to be initiated with a minimum amount of time lost.

Col. William T. Cumiskey, senior Air Force representative, uses a magnetic training aid for instruction in air-ground tactics at the Signal School.



MATS World-Wide Service

The vastness of the Military Air Transport Service is demonstrated, and the necessity for world-wide communication control is impressed upon the students on other field trips. As a culmination of their instruction in the great potential of air transport, students are air lifted on trips to other service installations as a practical demonstration of the rapidity with which ground troops may be moved over hundred of miles in a short span of time.

In addition to the roles played by the various combat arms, the tactics and techniques of special operations are also presented to the student. Outstanding of these is the instruction on the employment of airborne units and the participation in an amphibious exercise.

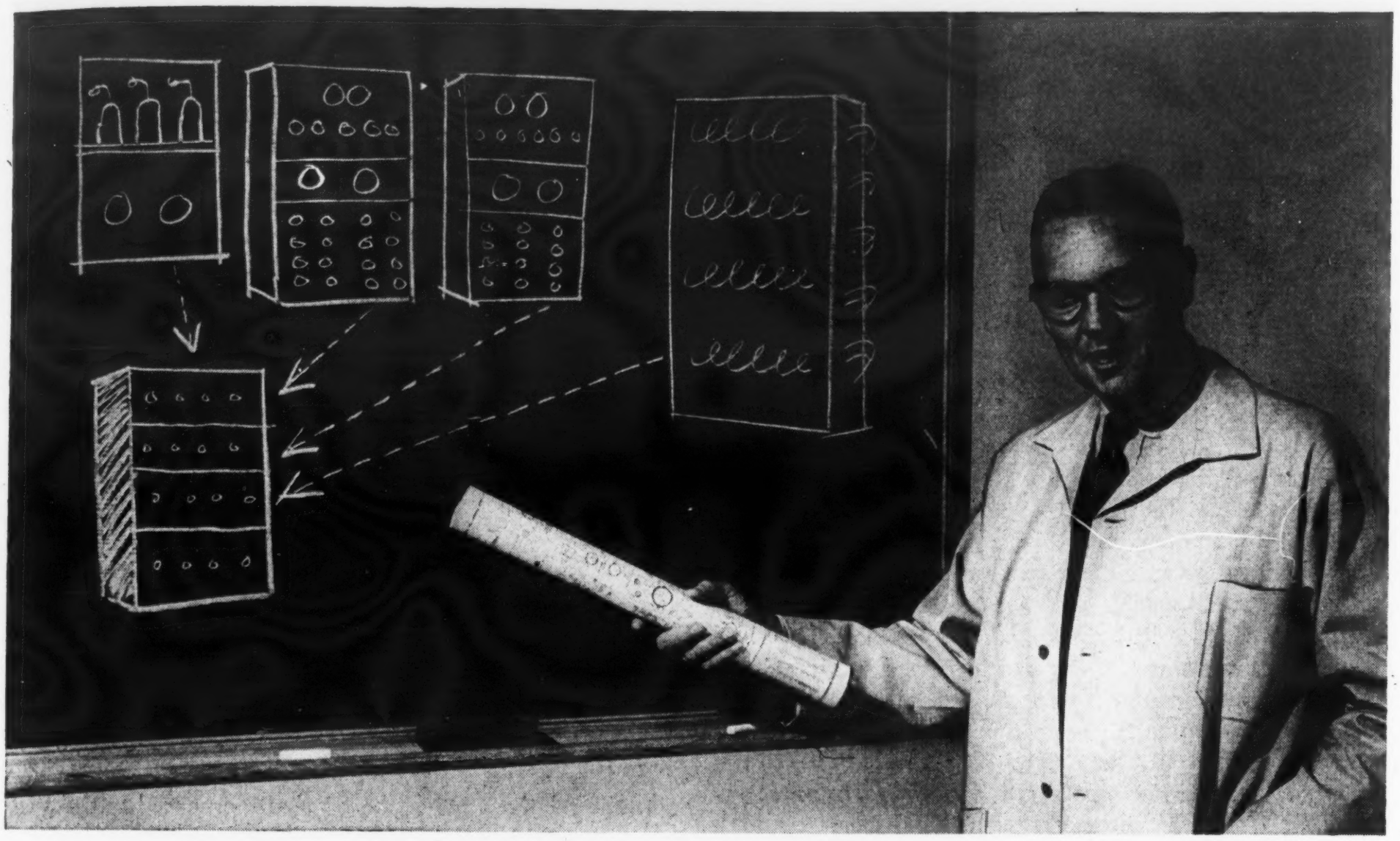
Airborne and Amphibious

In the case of the airborne instruction. emphasis is placed upon the flexibility and mobility of airborne forces, both in the tactical and strategic sense. A comparison between the Infantry and the Airborne Division is made; the restrictions imposed upon airborne operations are pointed out. The need for communications during an airborne assault is emphasized, and the student officer is required to solve a continuing map problem that highlights the principles of airborne operations. As a concluding part of the airborne instruction, a demonstration jump by the assault echelon of an airborne signal company is usually provided.

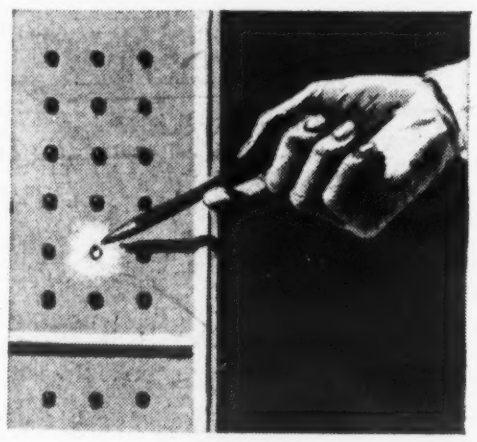
Amphibious instruction is conducted by the Amphibious Training Center located at Little Creek, Virginia. There the students are provided with the most modern of training aids and doctrine. Although methods of communication are stressed, sufficient tactical instruction is included to demonstrate the complexity of an amphibious opera-

(*Continued on page* 45, *col.* 3)

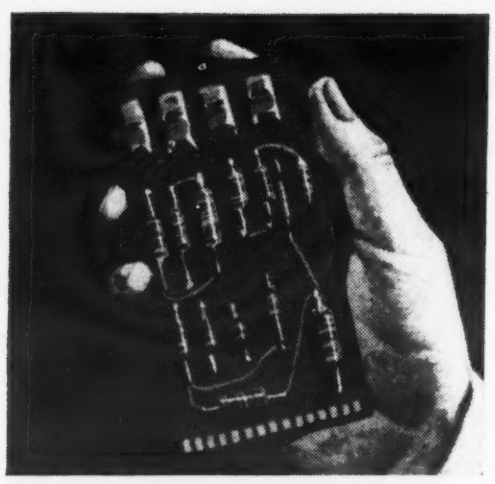
HOW TO PUT A ROOMFUL OF ELECTRONIC EQUIPMENT INTO A "SMALL" PACKAGE!



A roomful of equipment, designed for breaking down radar information into discrete signals for automatic transmission and processing, was turned over to Lewyt for engineering and repackaging. What happened was typical of what Lewyt can do.



Since the equipment must operate unattended with minimum risk of failure, standby facilities are included to take over automatically when any major failure occurs. Automatic indicators inform maintenance crews of nature and location of failure.



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Quotes in Review

a survey of major statements made during the past two months

"An evaluation of the merit of any communication circuit must be based on these three parameters—*distance, rate and reliability*. The history of radio shows a continual improvement in all three factors with many cases where one or two of them have been peaked up at the expense of the others.

"Because of the tremendous rate of growth of radio communication, it has been possible for some of us to have personally experienced a large percentage of it. I recall, back in 1915, operating a spark transmitter on ships of the Clyde Line operating between New York City and Jacksonville, Florida. We used carborundum detectors with no amplification. Code was transmitted on 5 to 6 hundred meters and our maximum range was 50 to 100 miles.

"By 1916-17 we had graduated to a galena crystal detector, and transmitter power had increased. At one time, during this period, I was operating on a ship tied up at Copenhagen, Denmark. Every morning at 5:00 A.M. we tuned in station NAA at Arlington, Virginia, 4000 miles away and copied the weather and news reports. NAA used a 100 Kw spark transmitter at 2500 meters (about 120 Kc). Checking this circuit against our figure of merit, it is obvious that distance is excellent, rate is poor (code) and reliability is good, but subject to a diurnal effect.

"In other cases, we found reliability subject to geographical location. A prime example was the so-called "San Salvadore dead spot", where operators complained that they couldn't work another ship even though they could see it. Skip distance associated with ionospheric transmission governed communications routes. In many cases, we couldn't work the Gulf Ports from positions in the Carribean, but New York and other Atlantic seaboard stations came in very strongly.

"This was also the heyday of broadcast DX. With only a few stations on the air. the DX fans sat up all night listening for station breaks 1 to 2 thousand miles away.

* * * * *

"It may be of interest to take a brief look at the multipath problem in television as a function of frequency. Although the complete radar art hinges upon the fact that radio waves are reflected from practically everything, this phenomenon is rarely a welcome one in the communication field. The result of multipath is that the same information arrives at the receiver more than once and usually at different times. This results in confusion which, in the case of TV, manifests itself as ghosts, and a net reduction in rate of information transmission.

"Although the exact relationship between multipath and frequency has not yet been fully explained, the following facts now stand out clearly:

1) At a great many points, the 2.5 Mc TV was hopelessly confused because of ghosts.
2) VHF television (54Mc-216Mc) also has a ghost problem but it is much less serious than at 2.5 Mc.
3) UHF television (470Mc-890Mc) is virtually free of ghosts.
4) All ghosting is much less serious at a distance from the transmitter.

"In line with (4) above, early New York and New Jersey experimenters frequently found in 1930 that they could enjoy the Washington and Boston transmissions when they couldn't get the ghosts out of the local ones.

"A second dividend resulting from the use of higher frequencies is the greater freedom from external interference, both natural and man-made. Both of these factors, the reduction of multipath effects and the reduction of interference, mean sharper, clearer pictures. In other words, the *rate* has been increased.

"I don't want to give the impression that the increase in frequency results in nothing but gain. While the rate of transmission is increased, the distance has been decreased. I believe this is painfully clear to some of the UHF operators. The decrease in distance is due in part to the relative state of the UHF art compared to the VHF art, but it is also partially due to adverse propagation conditions.

"As previously noted, there is no dependable ionospheric transmission above about 30 Mc. 20 years ago, it was assumed that transmissions on frequencies greater than this would be limited to line-of-sight paths with a slight leeway because of diffraction effects. However, as VHF transmission became prevalent, first with experi-centers, both commercial and amateur, then with widespread FM broadcast, and finally with millions of TV receivers, certain new facts emerged.

"Although Sporadic E transmission was about as expected, there was a very considerable amount of additional beyond the horizon reception. Especially in the summer, "abnormal" atmospheric conditions become the rule rather than the exception and long distance tropospheric propagation is very common. Although there are many possible tropospheric conditions which can account for the very low attenuation experienced, they all amount to the production of a downward refraction of the wave to an extent equal to or greater than the curvature of the earth. Thus the wave becomes trapped and may travel several hundred miles with only slight attenuation. These duct conditions prevail a good part of the time around the Gulf Coast and along the Southern California coast.

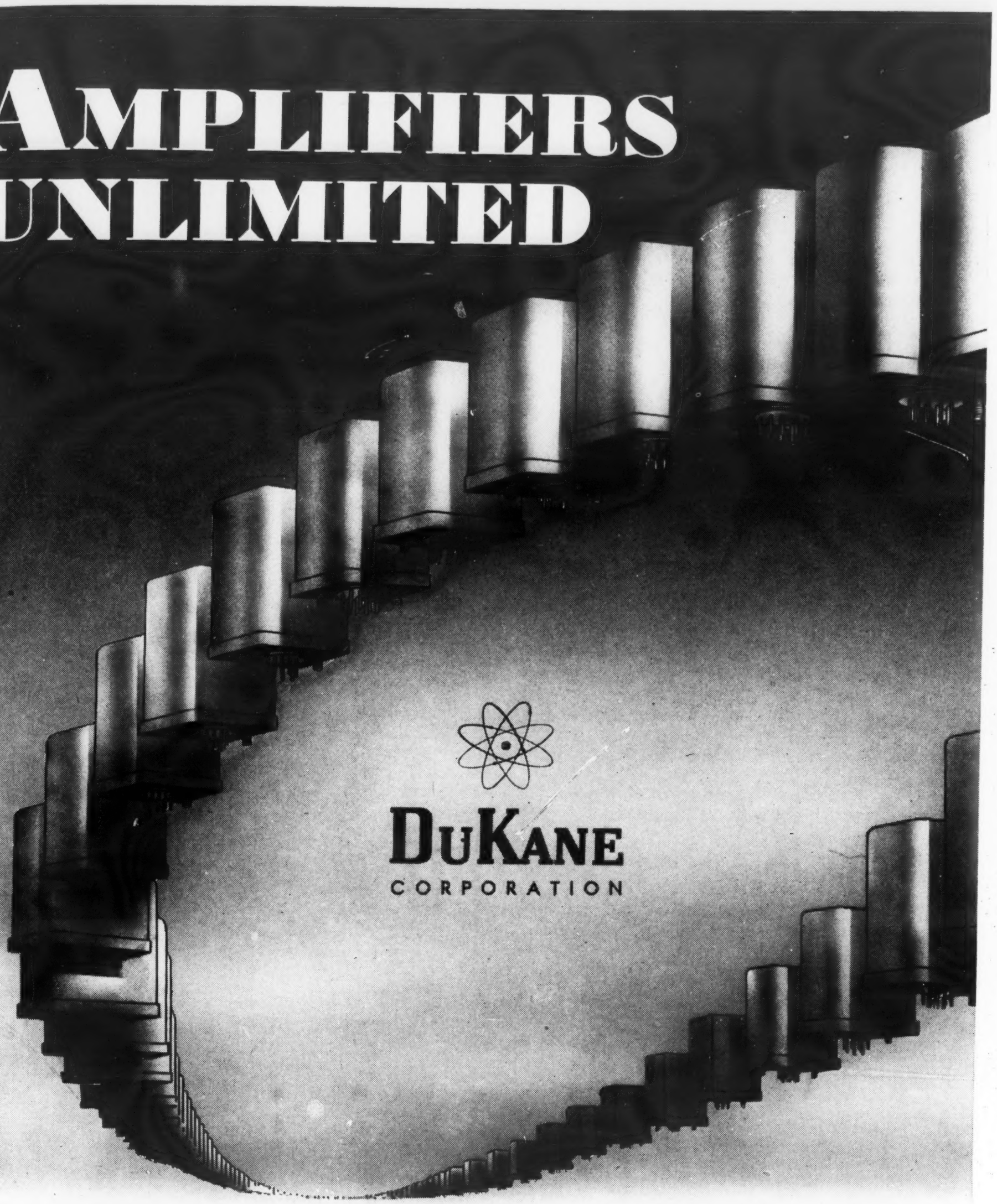
"In fact, the FCC has recognized this geographical peculiarity by requiring greater co-channel spacing along the Gulf Coast than in the remainder of the country.

* * * * *

"Considering once more our three desirable factors, it

(*Continued on page 37*)

AMPLIFIERS UNLIMITED



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can be seen that we've continually compromised one for the other, but have also continually improved the overall transmission. Probably UHF television is the best example today of a high rate of information transmission. The pictures are almost invariably sharp and clear. At short distances and favorable geographical locations, it is reliable, but it suffers from unfavorable geography close in and from fluctuating signals at a distance. Both of these faults are at least partly amenable to improvement as the art advances.

* * * * *

"At low VHF frequencies, (25-60Mc), scatter can occur in the ionosphere resulting in reliable communication over paths of the order of 1,000 miles. At higher VHF and UHF frequencies, scatter can occur in the troposphere or stratosphere resulting in paths of the order of 200-300 miles or possibly more. Originally, computations based on somewhat hypothetical conditions indicated that bandwidth (hence rate of information transmission) would be quite severely limited. Recent experiments indicate that this problem may not be as serious as was feared. This scatter transmission is simply a new step in the old problem wherein we have excellent reliability, excellent rate of information transmission and rather fair distance. Needless to say, all of these parameters are relative and the scientists and engineers will, of course, continue to seek improvements.

* * * * *

"Now let us take a brief look at some probable uses and results of this new technique. To what extent commercial use in communications can be made of scatter signals is pretty much a matter of conjecture at this stage of experimentation. There just isn't enough background of day-to-day commercial application.

"Nevertheless, the fact that UHF and VHF signals can be received reliably at distances up to 200 miles and 1,000 miles respectively cannot help but indicate widespread application in future years.

"First of all, we should probably look at possible future applications from the standpoint of economics. I think we are on fairly secure ground when we assume that UHF signals incorporating sufficient information for television pictures will be able to be transmitted satisfactorily for distances of 300 miles.

"Here in the United States, future use of this point-to-point transmission for television will be determined by the American Telephone and Telegraph Company. This Company has already made a tremendous investment in coaxial cable and microwave facilities in order to provide national interconnection for our television system. To what extent they would supplement or extend their networking facilities with 'forward scatter' equipment would undoubtedly depend upon down-to-earth cost comparisons. With the high power required and the amount of equipment necessary, the cost for 'scatter' communication is presently pretty high.

"Still on the subject of television, the really important potential for the use of scatter transmission must be in areas where it is impractical or impossible to install and maintain microwave or cable. No great vision or imagination is required to come very quickly to the conclusion that this new method for long range transmission makes trans-oceanic television possible.

"There have been a lot of statements and remarks in recent years about the possibility of a global television system. *'Forward scatter' very definitely gives the industry the tool by which it can be accomplished.*

* * * * *

"It is, of course, true that European television systems use different standards than ours. However, that has not been an insurmountable obstacle in the transmission from country to country in Europe, where similar differences exist."

"The Voice of America and Radio Free Europe are doing a great deal to promote international understanding. But I cannot conceive of any factor that is as capable as television for the promotion of global understanding and harmony. A complete global system may well be decades in the future, but certainly a start can be made now.

"I believe that it would be well worth the attention of Congress to study the feasibility of immediately establishing a live trans-atlantic television hook-up using scatter transmission techniques. It is possible in a very short time to have a link across the ocean. In my opinion, we ought to get going right away."

Dr. Allen B. Du Mont
IRE Symposium on
Communication by Scatter Techniques
Washington, D. C.

"In the case of an all-out military emergency, we may have to produce vast quantities of both large run and small run electronic devices, many of which will be far more complex than those we made in World War II. To the extent that the commercial components can, at that time, meet practical military specifications, the conversion from commercial production to military production will be greatly facilitated. This will require close cooperation between industry and government agencies involved, and some tightening of commercial standards.

"I also think that military specifications should incorporate commercial designs wherever our industry is able to demonstrate a high order of reliability in their standard product lines. That is to say, wherever performance under military environments and conditions will not be endangered, these new standard components should be accepted without major alteration."

Robert C. Sprague
Chairman of the Board and Treasurer
Sprague Electric Company
IRE Symposium on Automation
for Electronics
Cedar Rapids, Iowa

"I would like to discuss briefly a few of the major problems which the Army faces in adapting Electronic Data Processing Systems to its operations."

"EDPS in general is in a highly dynamic state because of the trends in electronic development and the highly competitive nature of the data-processing industry. Manufacturers and trade publications are constantly announc-

(Continued on next page)

ing improved and less expensive devices, engineering advances and developments. Agencies considering acquisition of computers have a difficult task in determining the most advantageous equipment. If decisions are delayed each time new advances are announced, it is conceivable that years would elapse before an agency would actually procure any equipment. Opinions have been voiced that this dynamic state will continue for at least the next five years. This leaves the Army in the position of having to test new concepts with equipment and systems which may rapidly become obsolescent. The problem is complicated not only by the large cost factor, but it does not permit easy planning for adaption of computers to logistical or combat operations.

"Another major problem is that of personnel, which is often a critical one in the Army. In working with data-processing systems, we need a large variety of skilled people: analysts, maintenance men, organization and methods examiners, to name but a few. These will have to comprise not only civilians, but men in uniform as well. The current labor market for EDPS personnel can best be described as great demand and little supply. This condition will get worse. Complicating the problem is the fact that many government personnel officers apparently lack appreciation of the complexities involved in EDPS. No adequate effort has yet been made to formulate standards and criteria for classification and recruitment of the kind of specialist we are going to need in increasing numbers. What we may expect to see happen is that the Army will serve as a training ground and recruiting source for private industry because of the pay differential.

"A third problem is of special interest to the Signal Corps. There is just enough difference in the design of each manufacturer's equipment to make them incompatible. Industry as a whole seems to have little interest in the development of compatible transmission equipment. Of course, this problem of standardization is no new one. At one time each manufacturer of vacuum tubes made his product just different enough from the others to make interchangeability impossible.

"In the case of computers, there is required a conversion of numerical and alphabetical information to coded information for input to the machine. Each manufacturer employs a different code system or a variation of the same code. As a result, tapes from one system cannot be processed by another. A voluntary adoption of a uniform coding system does not appear likely in the immediate future. Certain electronic firms have indicated that conversion devices can be developed, but use of these devices will entail additional cost and processing them.

"At the present time, data is capable of being electrically transmitted from point to point by teletype, telephone and radio. However, transmission of intelligence by any of these media is extremely slow, and only a transceiver which processes punch cards provides a self-checking feature to insure the high degree of required accuracy. Unfortunately, methods for the high-speed transmission of data from magnetic tape to magnetic tape have not been developed. Also this type of transmission presents an additional problem because of the incompatability between the varying machine codes and the communications codes. Communication firms have indicated willingness to develop the necessary equipment, but it appears that specific requirements and sponsorship will have to be furnished by the prospective user."

Major General W. Preston Corderman, USA
Deputy Chief Signal Officer
AFCEA Chicago Chapter

"I want to spend a few minutes in discussing some of the factors which are important in carrying out a military research and development program. These are not new factors, but ones which I consider warrant additional emphasis in order to make our work in this field have maximum effectiveness.

"In setting up and carrying out our R&D programs greater demarcation is needed between the long-range research and exploratory development on the one hand, and, on the other, the immediate objectives of specific developments of designs to be produced and used. Herein lies some of the difficulties of our program for the provision of military weapons.

"In the exploratory phase, multiple approaches are justified and desirable, in the search for the best answers. In the second or design-development phase, it is desirable to narrow down to the best combination of the results of the exploratory phase. The exploratory phase is searching with imagination for promising approaches and is generally not suitable for definite time objectives. The design-development phase, however, is directed at a specific objective along a course which should be definitely programmed and closely scheduled. All too often in our recent military programs the desired multiple approaches of our exploratory work have continued, without adequate scrutiny and resolution, into the specific design of several devices and their production and use.

"The multiple approach in the exploratory phase is desirable and is not unduly expensive. It is a way of insuring the attainment of a good final answer. Multiple approaches in the design-development, however, can be quite expensive and unless checked, put too many kinds of things into production and use. Today with the prolificness of our expanding technology, it is easy to make a number of steps of relatively small improvements in advancing towards what we consider to be our ultimate objective. We need to make our steps represent major advances in order to avoid having too many devices in our inventory and—probably of greater importance—to conserve our technical manpower.

"After the exploratory phase of our developmental activity, it is well to stop, look, and listen. This is the time to match closely the potentialities of the exploratory phase with service needs; to define the proposal of something for production and use; to indicate its performance; to explore and appraise its scope and magnitude of application; to estimate the most promising approach, the time and cost schedules for achieving the result, and the likely areas of difficulty in attaining the goal.

"This study should point out also the collateral activities required and the needed facilities and personnel. At

this stage, the endeavor should be to think through the likely procedure to the goal and to seek for the stumbling blocks that may be encountered. With the technological complexity of today and the attendant numerous ways of attaining an objective, the project definition and planning is a tool which supervisors of R&D programs need as a management tool. The job cannot be done properly without this kind of study and planning. It is necessary in order to determine which projects should be promoted and at what priority they should be carried through.

"My second factor has to do with the planning of the R&D programs. First, we should have a concept of the program to provide the range of things needed to carry out a mission. For example, the program for the mission of protecting a target with surface-to-air guided missiles should include the several devices that may be planned for this purpose, properly coordinated as to the respective applications of each. The program should also be an integrated one for a period of time—say five to ten years. In this way, we bring into our concept the things that we would like to have the future technology make available. Then, with what we have at hand and what we see is potentially available at some future time, we are in a better position to determine the nature and magnitude of the steps which we should take in getting from where we are to where we want to be. Such planning should help us to fulfill the mission comprehensively with properly coordinated devices and to avoid intermediate projects which are marginal in their improvements or likely to be obsolete when they become available.

"This matter of avoiding obsolescence in the inventory of our weapons is one which requires today skilled judgment to a higher degree than ever before. The weapons that we use in anger cannot be obsolete with respect to those of the enemy.

"The third point that I want to stress is the need for close association of this R&D program with the military plans for the mission to be carried out, qualitatively and time-wise. The purpose of this association of the R&D programs and the military plan is to permit each to react on the other for the determination of optimum adjustments of each with the needs and possibilities of the other. This concurrent consideration of the R&D program and of the military planning to fulfill a mission and their consequent interaction on each other, I consider to be of outstanding importance both to research and development and to operations.

"The endeavor to analyze our problems systematically; to determine and quantize relationships; to postulate performances and situations, and to estimate consequent operations and results—these we have come to know as operations research, or,—as I prefer to call it,—operation analysis. This is my fourth factor in this series. We need to advance the use of this tool and the skill in its use. Its effectiveness is dependent not only on those who wield it, but on the knowledge and receptivity of those who pose the problems and are the potential beneficiaries of the indicated solutions. This is a two-way operation. We have probably made more progress in the wielding of this tool than we have in integrating its potentialities into our daily operations. There is need here for a greater interlacing of the thinking and appreciations of both the analysts and the operating heads.

"My fifth factor has to do with the handling of the Army's R&D program as a team operation. With the scope and magnitude of the programs, with the widespread location of the various Army agencies, and with the fact that so much of the work is carried out by university and industrial agencies presents quite a problem. With the limitations of our supply of skilled scientists and engineers, and with the expanding demands for new military devices and systems to do more and more next-to-impossible tasks, we must exert strenuous efforts to make the most of our available talents.

"We have here a problem of mass communication. Within the last month, I have attended two gatherings of top scientific people in the Army R&D organizations. This is one way of promoting a knowledge of the problems, experience and capabilities of other agencies and other people. Direct horizontal relationships can be most effective in accomplishing this.

"Another aspect of this is the need for developing the attitude that the interests of the individual, the group, the laboratory and the Army are the same. It is a matter of not only advancing the solution of our own problem, but also of helping the other fellow, the other agency, the other technical service, to solve their problems. It is the interest of achieving technological superiority across the board—Army-wide."

Honorable William H. Martin
Director of Research and Development
Department of the Army
AFCEA Washington Chapter

"Because we do not have sufficient Reserve, Congress passed a new law. The Reserve Forces Act of 1955 is designed to provide trained manpower for the Reserve Forces. Without pretrained enlisted men, Reserve units cannot fulfill their mobilization roles or local missions.

"The goals to be attained by 1960 are:

1. A Ready Reserve of 2.9 million men, so organized and trained as to provide reserve strength for the first six months of general mobilization.

2. A Standby Reserve of about 2 million men in a non-organized, reserve pool for the later phase of mobilization.

"The biggest public relations problem before the U. S. Government today is to sell understanding of the reserve forces program and obtain full support of it. No single Government agency or a body of people defends the nation in war. No single agency can completely sell the reserve program. Combined public relations effort is required.

"Understanding of the reserve program is not to be extended only to the youth. The parents, the teachers, the employers, the unions, and the communities must understand it, and cooperate to insure its success."

General Williston B. Palmer, USA
Vice Chief of Staff, U. S. Army
The 8th National Public Relations Conference
Public Relations Society of America
Los Angeles, California

Measuring Velocity of Underwater Sound

by Martin Greenspan and Carroll E. Tschiegg
National Bureau of Standards

MEASUREMENT OF THE SPEED OF sound in large bodies of water has long been a problem to oceanographers. The rate of sound propagation in rivers, lakes, and oceans varies not only with temperature but also with the depth and the salinity of the water. Thus, in fresh water sound velocity varies from 4600 feet per second at 32°F. to 5010 ft/sec at 100°F. At a salinity of 41 parts per thousand, the corresponding values are 4780 and 5140 ft/sec. Sound velocity in water also increases about 1 ft/sec for each 55-foot increase in depth. Several other factors, not all of which are well understood, influence the velocity of underwater sound.

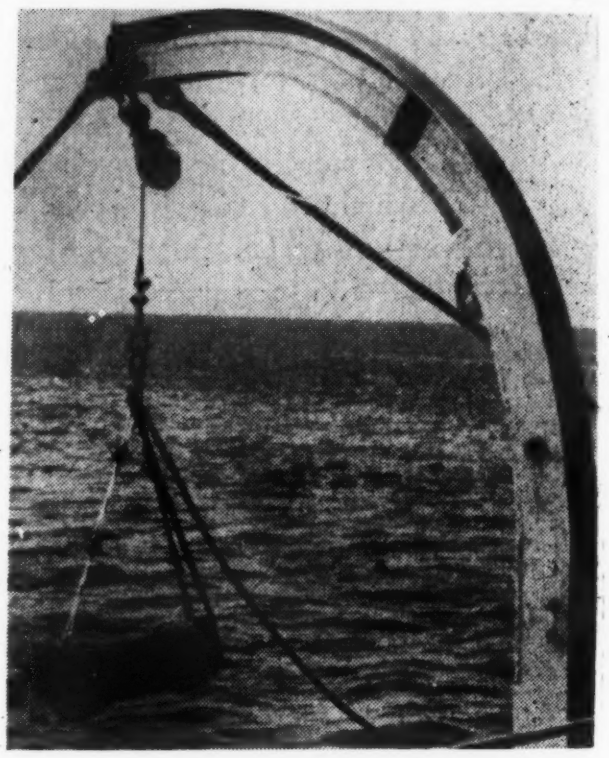
The sound velocity gradients due to these variables produce curvatures in rays of sound propagated in the sea. In some instances reflections are produced if, as is often the case, the thermal or salinity gradients are abrupt. These effects make accurate measurement of underwater sound velocity more difficult, especially where a long-distance sound path is required.

In 1827, Colladon and Sturm measured the speed of sound in Lake Geneva, Switzerland by timing the travel of a sound wave produced by an underwater explosion. Although their timing equipment was crude by modern standards, they obtained reasonably accurate results, and their method has continued in use for over a hundred years.

Since 1927, the use of radio techniques for measuring the time of travel has materially increased the precision of this method. However, the time of travel of the explosive sound wave still cannot be accurately determined unless it is measured over a half mile or more of open water. Obviously the many variables, such as temperature and salinity, which affect sound velocity cannot be expected to remain constant over such a distance.

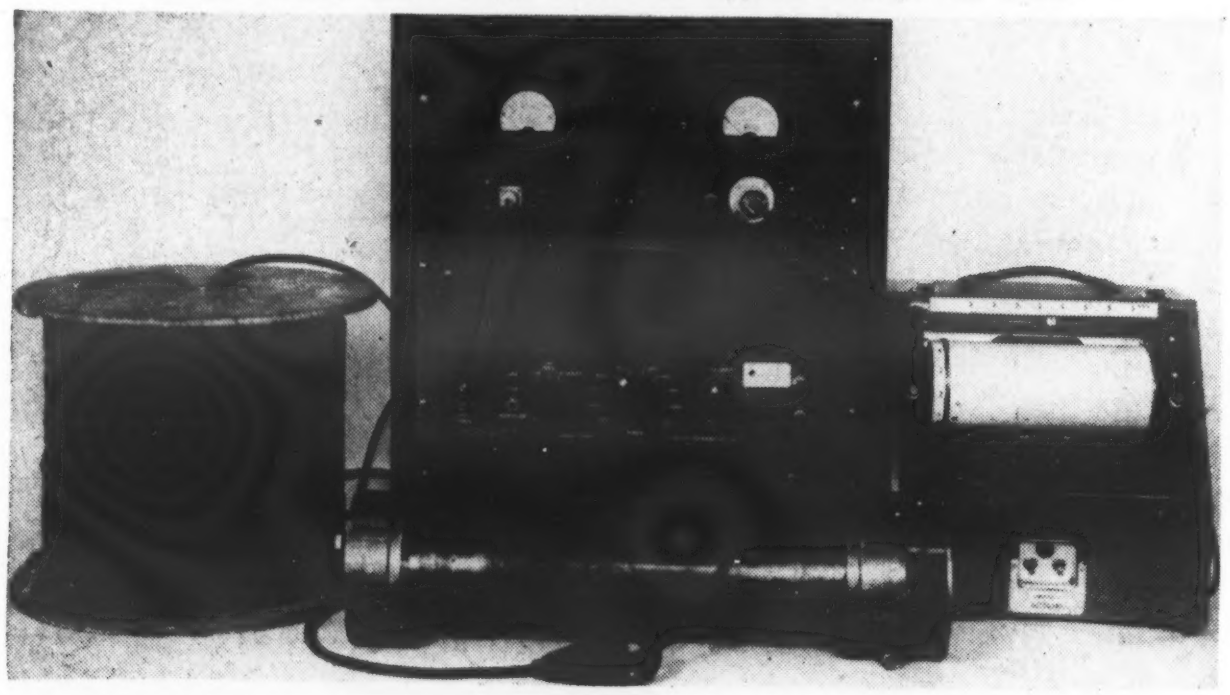
For this reason, other methods which do not require so long a sound path have been under investigation in recent years. One of these is similar in principle to the explosive method but uses a high-frequency sound pulse instead. Another measures the phase shift in a sound wave as it travels from an underwater sound source to a receptor.

At present, the sound velocity at ocean depths is usually determined by measuring the temperature at a given depth and then calculating the appropriate velocity from the measured temperature and an assumed salinity. In practice a bathythermograph is lowered into the ocean to the required depth. This instrument consists essentially of a recording thermometer and a pressure recording device. The pressure reading gives the depth while the thermometer indicates the temperature of the water at that point. Tables are used which give the sound velocity for a given temperature and salinity as determined experimentally by the explosive method or in the laboratory.



The brass "fish" being lowered into the water. The fish contains the piezoelectric crystals and sound reflector which provide the underwater sound path.

Assembled below is the equipment used in measuring the velocity of underwater sound. In the foreground is the brass "fish"; to the right is the recorder which automatically plots sound velocity versus depth. Power is supplied through the cable.



Although widely used, the bathythermograph has obvious disadvantages. In the first place, it takes into account only two factors—temperature and depth—that influence the velocity of underwater sound. The actual value of salinity is usually unknown, and other factors are ignored completely. Another disadvantage is the time required to obtain readings and to make the necessary computations. This may be an hour or more. Meanwhile, sound propagation conditions may have changed considerably.

Seeking a more rapid and accurate method, the National Bureau of Standards recently developed an automatic underwater velocimeter for the Office of Naval Research. This instrument reduces the effect of variations in temperature, salinity, and other factors by

(*Continued on page* 45, *col.* 2)

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164-1A1

The answers of Sperry Gyroscope Company to the question of what to do in case of emergency

Disaster Planning Requires More Than First Aid

by C. G. Holschuh
Executive Vice President and General Manager
Sperry Gyroscope Company

WHEN PEOPLE TALK ABOUT DISASTER PLANNING IN industry they are usually thinking primarily of providing for first aid, rescue and fire fighting. Some will even think in terms of salvage and reconstruction. But two principal steps are usually neglected.

The first requires that one explore thoroughly just what is meant by disaster and what sort of assumptions should be made about it. This is not a popular step because it involves perplexing unknowns and is, therefore, not straightforward or clean-cut. The second requires that one consider management continuity—the succession of command. This need not be difficult, particularly if responsibilities of management personnel are clearly defined in day-to-day operations. Rather than to treat just these two aspects, however, I would like to sketch the whole range of elements which we consider part of our disaster plan.

What do we mean by a disaster? Enemy attack, presumably by means of nuclear weapons, is foremost on our minds, of course. Sabotage is another related problem. Beyond this, however, the recent hurricanes and floods, as well as the catastrophic fire at General Motors not so long ago, are still vividly with us.

The possibility of atomic attack poses the most complex problems, since it is likely to affect the plants' environment most extensively and may not afford us a stable period of immediate restoration. We have made a number of assumptions about this possibility:

1. The plant will be somewhere on the periphery, rather than at the center of attack. In the latter case, there would not be much to rescue or rebuild.
2. All water from current regular and emergency sources will be needed for fire-fighting and none will be available for drinking or medical purposes.
3. Radioactive fall-out may continue for hours. About 10% of the employees will be exposed to radiation and require "washing down."
4. The majority of casualties will be due to blast damage.

Disaster Plan Outlined

Accordingly, we have considered the following elements of a disaster plan for our company.

Alarm System

In case of enemy attack, there may not be much warning, every minute will count. We have, therefore, hooked up directly with Civil Defense headquarters by means of the "Bells and Lights" warning system. This system will flash all stages of an alarm instantly to our control centers.

Emergency Organization

We have adopted the principle of adhering to our

regular organization as much as possible, even during the period of immediate emergency. This is based on the assumption that, in a period of danger and confusion, people will more naturally tend to follow established supervisors and channels of communication than a completely new and strange leadership. For this reason we plan to use our key supervisors in various plant areas as our emergency zone commanders and to train them accordingly. Adherence to our regular organization is made easy, in our case, since it already contains well established security, fire, medical and building departments functioning at present.

We are deviating from the regular organization only in two major ways. We believe that we must have a single person who is familiar with the disaster organization and its potential problems, and who therefore plays a major role in time of disaster. This person is our Security Manager, who is in charge of security which includes the fire departments. When the alarm sounds, he will report directly to the Executive Vice President and General Manager, and all Zone Commanders will, in turn, report directly to the Security Manager, rather than up the line to divisional Vice Presidents. The Vice Presidents will form a Disaster Council which will include our Director of Public Information. This Council will also report directly to the Executive Vice President. In this fashion we are preserving approximately the present channels of organization up to the Zone Commanders, but are interposing a single person of special competence between the Zone Commanders and the principal operating executive.

While each Zone Commander will have his first-aid teams, exit guards, auxiliary guards, squad monitors, auxiliary firemen, male and female searchers, and messengers, the Security Manager will continue to have direct control over the main professional security and fire departments. He will also assume command of the Medical Director, the Building Services Manager (who will handle damage control and heavy rescue work), a Communications Chief (handling telephone, radio and messenger services), a Traffic Manager, the Control Center Supervisor and the Civil Defense Coordinator (handling contact with outside civil defense agencies). Everybody not part of this central emergency organization will be under the jurisdiction of his respective Zone Commander.

Rehabilitation Organization

After the conclusion of the immediate emergency, the Security Manager will continue in charge of the Emergency Organization. The Building Services Manager becomes head of a Rehabilitation Organization, and will report directly to the Vice President for Operations. Personnel will be transferred to his organization from the Security Manager as quickly as they can be made available. Once rehabilitation starts, the Vice Presidents will resume their responsibilities in the line organization and start to rebuild their regular working organization.

Identification

Emergency Organization personnel will be identified by such devices as arm bands, badges, cards, windshield stickers, and/or white helmets. Rosters of all such personnel will be maintained by the Security Manager.

Facilities, Equipment and Supplies

Our present in-plant medical facilities and supplies are generally adequate to deal with a disaster. In addition, our plan provides one litter and first aid kit at each zone, 50 bottles of plasma substitute stored at the hospital, as well as 1,000 blankets, 100 coveralls, and 4,000 identification tags, and 4,000 coveralls and slippers for employees who may have to be washed down after exposure to radiation.

The plan calls for the hospital to store 5,000 gallons of water for drinking and 10 to 15,000 gallons for decontamination purposes. The medical department will be responsible for having three decontamination teams, fully equipped with appropriate suits, survey meters and handie-talkies.

We are ready to convert company vehicles to ambulances, if required. We are also installing radio communications between our plants in the Long Island area. Otherwise, our present telephone and public address systems are adequate; besides, we are at present operating a number of two-way radio cars and other portable communication equipment. Our present fire trucks and equipment are adequate, too. We are operating two fire trucks and several extinguisher-carrying bikes at our Nassau plant, and 5 crash and fire trucks at the MacArthur airport.

Our cafeterias have sufficient food supplies on hand to feed the present workforce for 30 days. We count on the regular metal containers and refrigerators to protect food against radiation. Local sources of drinking water can be tapped with relative ease. Our building services have adequate equipment and supplies for rescue and repair work. However, we do not believe that stocking up on structural steel or similar materials would be practical. We will always have to rely on vendors for some major repairs. We have alternate power and light sources and do not plan to make any further provisions for emergency heat and ventilation. We plan to publish shutdown procedures for emergencies.

Training and Instruction

We are posting a permanent bulletin on all bulletin boards, containing principal instructions to all employees. We also plan to hold a fifteen-minute drill at the end of the day shift every six months. These drills will simulate fires, involve some evacuation, the use of emergency equipment, and assembly of control center personnel. In addition, we plan to give specialized training to our Zone Commanders, auxiliary fire, security, first-aid, rescue, and decontamination teams.

Finance and Insurance

The desirability of dispersing funds is one of the less obvious aspects of disaster planning. Our funds are presently located in eleven banks, and authority to draw on them is delegated to 20 widely-dispersed individuals in the New York area. Our principal bank is prepared

to move operations to an upstate location in the event of disaster. Even if our exact current balance were not available, we could draw on credit. Any further dispersion of funds and signing authority for disaster purposes has been abandoned in general in view of the communication and transportation problems which are likely to arise and reduce the benefit of such dispersion.

No insurance coverage is available for damage arising out of war, to fixed property on land. However, Congress is currently studying means for providing some coverage of this nature against nuclear damage.

Vital Records

A comprehensive vital records program is currently being installed in consultation with the National Records Management Council. It will utilize a vital records center, maintained by one of our Western affiliates, for safeguarding such material. Meanwhile, we have learned a great deal about what is a "vital" record. We have learned also that it is not necessary to duplicate and send away every vital record in order to achieve protection. Such protection is frequently accomplished by prudent utilization of existing copies, by relying on copies at vendors or in the Government records, and by evacuating originals in some cases.

Outside Liaison

Contact has been established with local Civil Defense authorities, police, fire, hospital, Red Cross, local governments, etc. Liaison has also been established with the Electronics Division of the U. S. Department of Commerce's Business and Defense Services Administration. The latter has been instrumental in promoting interest in industrial disaster planning and encouraging action.

While the Civil Defense Coordinator at Sperry will maintain liaison with local Civil Defense groups, it will be the responsibility of the Director of Public Information to conduct relations with the press and radio in the event of an emergency.

Disaster Manual

Standard practice manuals outlining policies and procedures have served this company well for many years. We are now establishing a disaster section of our manual which covers a chart of the emergency organization, its major position descriptions, emergency instructions and procedures, places of assembly, etc. This manual will be maintained and kept up to date by the Security Manager.

Movement and Evacuation of Employees

We have abandoned the idea of underground shelters as being prohibitive from an economic viewpoint. We do not plan to evacuate any personnel in the event of disaster, except where a specific area is endangered and unsafe for occupation. In this case, we plan to evacuate to the nearest parking field. Cafeteria areas will be used as emergency sleeping quarters, if necessary. No one will be allowed to leave his work area or plant once an alarm is sounded, except if specifically authorized in advance. Telephone calls to private homes will be severely restricted, if allowed at all during the initial period, in order to keep the lines free for emergency communication. Private calls will be allowed, however, as the situation gets under control.

No practical advance planning can be undertaken as regards hardship cases, and arrangements will have to be made on the spot to suit the circumstances. This may include emergency payrolls and liaison with the Red Cross and various welfare agencies. In order to be able to cope with a disaster occurring during non-working hours, some emergency personnel will be instructed to proceed to the plant upon sounding of an alarm. General recall procedures will be published also.

Restoration of Production

Since neither our needs nor the availability of communication and transportation can be predicted for the variety of situations which might arise, no plans can be formulated at this time for such matters as replenishment of workforce, temporary relocation and additional subcontracting. Suitable arrangements will have to be made as circumstances demand. However, we do have an extensive purchasing and subcontracting activity which would become an important factor in our emergency program. We have compiled a list of the names and addresses of our current and potential suppliers and subcontractors; we also have a record of our production and test facilities and a file of purchase specifications for our production and test equipment, materials, and components. This information is being stored away safely under our vital records program. It will enable us to re-establish our supply lines and to secure, without delay, equipment and materials needed to restore our facilities and to resume operation, even if our production and purchasing records should be destroyed and our experts unavailable.

Dispersal

Recent and contemplated expansions in plant facilities involve locations in dispersed geographical areas. This dispersion of our facilities not only satisfies second-source requirements of the Department of Defense, but assures our owners that segments of our business will be beyond the reach of disaster. This dispersal through expansion is aided by our continuing program of decentralizing management along product lines.

(*Continued on page* 49, *col.* 1)

The bulletin reproduced below is posted permanently on all Sperry plant bulletin boards.

Disaster Plan

The following instructions are part of the Disaster Plan of this Company and should be followed in case of emergency.

The area in which you are now located is one of thirty-four disaster zones into which Sperry facilities are divided. Each of these zones is headed by a Zone Commander, assisted by two alternates, and responsible for the Zone's first aid team, its auxiliary guards and firemen, squad monitors, and other emergency personnel. Central fire-fighting, security, medical, rescue, repair, and other emergency forces will stand by under the responsibility of the Security Manager.

An alarm over the public address system will advise you that this disaster plan is going into effect. This may not only be due to an enemy air raid, but also due to a local fire or other emergency.

If you have not been assigned duties under your Zone Commander, on an alarm, you are to do the following:

1. **Cease work—shut off your operation.**
2. **Remain at your present post.**
3. **Be calm, quiet, and orderly.**
4. **Do not use the telephone.**
5. **Follow the orders of your Zone Commander and his staff.**
6. **If you are away from your home station, return to it, except in the event of a surprise attack without warning, report to nearest zone assembly area.**

Your zone number is .....

Your Zone Commander is .....

Learn the name of your Squad Monitor! Ask your Foreman or Section Head.

Your cooperation means success for this plan!
Success for this plan may mean your life!

Electronics in Nuclear Power Plants

(*Continued from page* 26)

ship's atmosphere. An alarm system is used to provide early warning of excessive radiation.

Portable radiation monitoring instruments are similar in function to the fixed installation and are used for surveys and for checking the radiation level of specific locations. Personnel monitoring consists of devices which show the accumulated external radiation dose of an individual acquired by that individual over a given period of time.

The arrival of naval nuclear power, with the attendent high temperature, high pressure, hi-shock and high reliability requirements, has presented a new challenge to electronics.

Magnetic Amplifiers Used

Reliability of electronic equipment, for example, has been given a new meaning. When a radar, or sonar, or communications equipment fails, one of the functions of the naval vessel has been temporarily suspended, and the vessel "blinded" in one respect. Failure of critical components in a reactor control system, however, may cause a complete shutdown of the plant and immobilize the entire ship. For this reason, it has been necessary to require that electronic components and sub-assemblies have a longer life, a longer time between failures, more rugged shock-proof and vibration-proof characteristics, be able to perform at higher temperature, and not be adversely affected by higher radiation fields.

The trend has been away from vacuum tubes and toward magnetic amplifiers in many applications. The recent improvements in temperature characteristics have made transistors increasingly attractive for nuclear power applications since they already have the advantages of size, weight, ruggedness, and power economies. Further testing of transistors is necessary, however, to prove their continual reliability for this important application.

There are a number of other improvements that can be made in the electronic field as applied to nuclear power. For example, it is now considered necessary to have duplicate sets of instruments for one reactor to obtain sufficient reliability. Improvements in reliability would eliminate this need and greatly simplify the plant. Also, a wide range neutron detector would simplify the nuclear instrumentation considerably by eliminating the requirement for several overlapping ranges of instruments. These are two examples of the improvements that can be made in electronics that will improve nuclear power plants.

Future Challenge

As was stated initially, the chief reason that electronics is able to make contributions to nuclear power plants is its ability to detect and measure radiation and present the data derived therefrom in a number of different ways. To date, in naval nuclear power plants, the reactor design has been conservative and the size, weight, and speed of response requirements have not been stringent. As reactor technology advances, these factors can be expected to assume greater importance and place upon the electronic industry demands for more versatile and sophisticated instruments and controls. The greatest contribution of electronics in the future will be to meet the challenge and provide more reliable instrumentation and control for nuclear power plants.

Combined Arms Instruction

(*Continued from page* 30)

tion. This training culminates with an actual landing exercise during which the student participates in the role of a landing force communicator at various levels of command. Landings are made from landing craft loaded from an assault transport. Every effort is made to provide maximum realism in the execution of this exercise.

Training in the tactical employment of the combined arms is, of course, supplemented by concurrent training in general staff functions and operations, as well as those subjects required by the Commanding General Continental Army Command. Phased in at the appropriate time are the technical Signal Corps subjects which are required for a complete understanding of the problems presented to the students.

No matter what the rank of the officer attending The Signal School, the Combined Arms team gives him a complete review of the other side of the picture. The Signal School graduate can meet with his brothers in the combat arms, secure in the knowledge that he knows something of the problems which face them and also knows the important part that he, as a communicator, plays in the successful accomplishment of their common mission.

Measuring Velocity of Underwater Sound

(*Continued from page* 40)

using a sound path of only a few inches. It provides a continuous plot of sound velocity as a function of either depth or time. Because of its high accuracy and almost instantaneous response, the velocimeter is expected to be a useful addition to underwater signalling and detecting apparatus. It should also prove to be a valuable research instrument in oceanography.

The NBS underwater velocimeter gives accurate results with a short sound path because it measures not the time required for a sound pulse to traverse the path once, but rather the rate at which the sound pulse is continually regenerated each time it reaches the end of the path.

The velocimeter consists essentially of a pair of piezoelectric crystals of polarized barium-calcium-lead titanate and a reflector, mounted to form a sound path of fixed length. The sending crystal is connected to a pulse generator, and the receiving crystal provides the input for a high-gain pulse-shaping amplifier. The amplifier output retriggers the pulse generator, which then applies another pulse to the sender. The sender in turn produces in the water a sound pulse to actuate the receiver. Thus, the system continually regenerates a sound pulse whose repetition rate, or frequency, depends on the time it takes the pulse to move through the water. Since the path length is fixed, the frequency depends only on the speed of sound through the water and on the circuit delays. Any variations in sound velocity are recorded as variations in the operating frequency of the velocimeter.

The electrical pulse applied to the sender has a very short rise time, and its leading edge is a precise reference point for the location of the pulse in time. On the other hand, the received pulse is much distorted and rises relatively slowly because of selective attenuation by the water. The high-frequency components of the pulse, which control the rise rate, are attenuated to a greater extent than are the low-frequency components. The fast rise is restored by amplification; nevertheless, there is introduced an unknown delay

(*Continued on page* 49, *col.* 1)

IT'S THE NEW VARIAN VA-97 KLYSTRON . . . a tough, reliable local oscillator tube with performance and design features unmatched by any other klystron in the frequency range of 34.0 to 35.6 kMc . . . ideal as the microwave power source for airborne radar and similar applications.

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EXCEPTIONAL FREQUENCY STABILITY under all conditions, due to Varian's advanced external tuning cavity design.

SLOW TUNING — gives you more reliable system operation with less maintenance.

RATED FOR USE AT ANY ALTITUDE without pressurization.

These important features allow maximum latitude in equipment design and result in savings of time, space and money. A companion klystron — the VA-94 — is also available, providing comparable performance characteristics in a frequency range of 16.0 to 17.0 kMc.

	Frequency	Resonator Voltage	Power	Electronic Tuning Range
VA-97	34.0 - 35.6 kMc	400 V	15 mW	90 Mc
VA-94	16.0 - 17.0 kMc	300 V	40 mW	75 Mc

FOR TEST EQUIPMENT AND LABORATORY MEASUREMENT . . . Varian's V-39C and V-40C klystrons feature separate external cavities that afford an extremely wide tuning range for testing and laboratory research applications, in frequency ranges between 10.0 and 21 kMc.

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SUPPORTING RESEARCH IN FUZE DEVELOPMENT

by Robert B. Buckmaster

THE ROLE OF SUPPORTING RESEARCH in the fuzing of modern weapons might well be compared to the search for a better mouse trap. The methods of fuzing which are used today bear little resemblance to those methods used a short fifteen years ago. This change of face can be attributed to two major changes in weapon systems and fuzing: one, the ever increasing use of guided missiles and rockets, and, two, the introduction of the proximity fuze during World War II.

In the field of warfare the proximity fuze was one of the most important weapon developments. This fuze enabled the armed forces to achieve weapons effects which were previously unheard of.

The Ordnance Development Division of the National Bureau of Standards was one of two major proximity fuze laboratories during World War II. In September 1953, by joint agreement between the Secretaries of Defense and Commerce, this division became part of the Ordnance Corps, Department of the Army, and was called the Diamond Ordnance Fuze Laboratories (named for Harry Diamond, one of the original pioneers in the field of proximity fuzing who, until his death in 1948, was chief of the Ordnance Development Division).

One of the major facilities of the Diamond Ordnance Fuze Laboratories (DOFL) is the Supporting Research Laboratory. This Laboratory has as one of its major functions, the development of the "better mouse traps" which are required in the ever expanding field of fuzing.

The Supporting Research Laboratory performs basic research and engineering applicable to the field of fuzing, as well as highly specialized professional and technical assistance through the solution of general and specific fuzing problems. In addition to performing this sustaining function, this Laboratory also conducts independent scientific investigations.

The Laboratory is composed of three branches; the Ordnance Research Branch, the Electron Tube Branch, and the Components and Materials Branch.

The Ordnance Research Branch, the only branch in the Supporting Research Laboratory which actually develops fuzes, provides basic and applied research and mathematical services in developing and evaluating fuze components and circuit applications. Typical investigations cover magnetic devices such as special purpose transformers and permanent magnetic assemblies; transistors, their characteristics, circuit applications, statistical testing, and the development of special instrumentation such as electronic analog computers in which electromechanical elements would operate too slowly.

Mathematical services, by a group of mathematicians and mathematical physicists, consist of reduction of test data and theoretical circuitry to equations capable of being verified in practical application of the devices or systems when these are completed and tested under actual or simulated

An amplifier utilizing printed circuits and subminiature tubes is compared with its out-of-date counterpart. These were designed by Diamond Ordnance Fuze Laboratory engineers.

Mr. Buckmaster is the Alternate Chief, Technical Information Branch of the Diamond Ordnance Fuze Laboratories.

conditions.

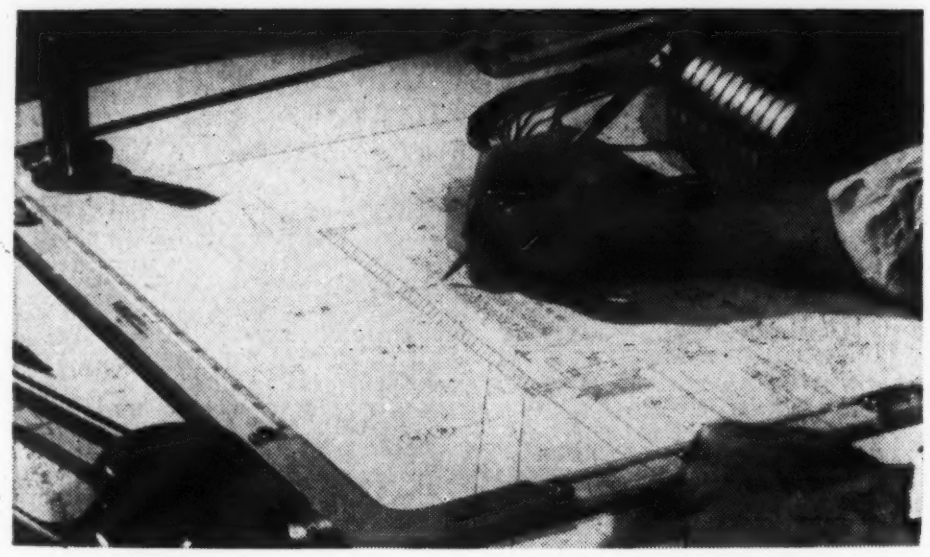
The basic circuitry investigations are undertaken to explore the possibility of producing new circuits which will accomplish certain functions, such as simulating signals obtained under natural operating conditions, etc., and involve not only rearranging conventional components into new circuitry, but also the use of new materials, components, and techniques. An example of this type of investigation is work which is being done on the application of ferrite magnetic materials at microwave frequencies to solve certain instrumentation problems.

One of the projects being conducted by the Ordnance Research Branch is the development of an ultrasonic flowmeter which measures the velocity of a fluid by measuring the difference in times of transmission of an acoustic wave in the upstream and downstream directions. The acoustic wave is propagated in the fluid by pressing a barium titanate transducer against the outside wall of the tubing carrying the fluid. The wave is then picked up by a similar transducer acting as a receiver and mounted on the tubing a short distance away from the first transducer. The reversal in direction of propagation is effected by interchanging the functions of the two transducers, i.e., making the transmitter the receiver and vice versa.

The time measurement is made in terms of the phase difference between transmitted and received waves. The phase difference measured for propagation in one direction is compared with the phase difference measured for propagation in the reverse direction and the difference between these is an indication of the fluid velocity. This difference is measured with a synchronous rectifier. The transducer functions are switched rapidly enough so that, by means of electrical differencing of the two phase measurements, a continuous velocity indication is obtained.

Two methods of switching the transducer functions and performing the synchronous rectification have been employed. The first method utilizes a mechanically driven switch. The second method uses an entirely electronic system to perform both functions. This newly developed device is now being studied in connection with developing a new method for measuring rapid changes in the temperature of a gas.

The Electron Tube Branch performs research and development on specialized tubes for use in electronic fuzing tests and applications. Work in the branch covers the investigation of a wide range of tube types and solid-state devices. Typical research problems are: ruggedization of subminiature tubes, studies of secondary emission phenomena, breakdown processes in gas discharge tubes, improvement of electron tube operation, and the fabrication of specialized experimental devices.



The birth of a new electronics system, as a design engineer at DOFL prepares final drawings.

In addition to research investigations, the Electron Tube Branch is responsible for specific tube developments for special ordnance applications either in its own laboratories or in commercial tube companies. Tube development programs are a joint effort of the DOFL engineers and commercial tube manufacturers who work under contract. This branch has pioneered the use of noise vibration for evaluation of tubes.

The Components and Materials Branch is responsible for research and development in ordnance components, in printed circuits, and in materials and methods for their application. Research in ordnance components involves design and testing of such devices as resistors, capacitors and rectifiers. Research in printed circuits includes such activities as synthesis and testing of printing-ink formulations and design of machinery for producing printed components.

Research in materials and methods for their application involves such tasks as synthesis and testing of new casting resins for use as dielectrics, and development of procedures for their use in fuses. These programs embrace many of the major fields of science, i.e., physics, chemistry, and engineering. Thus, the personnel of this branch have the unusual opportunity to engage in more than one of the various fields of the physical sciences.

Assumed Situation

In order to obtain a more integrated picture of the functions of supporting research, imagine that the need arises for a completely new type of fuze. (Due to security regulations, this example bears no resemblance to any known actual fuzing system.) The laboratory which has been given the task of developing the fuze finds that many unusual problems have arisen which require entirely new components and circuits peculiar to this fuzing application. At this stage of development, the DOFL Supporting Research Laboratory is called in. The proximity fuze which is needed is to be composed of a miniature radio transmitter and receiver, with a self-contained power supply, and with safety devices to prevent premature bursts. The transmitter must radiate sufficient power, and the receiver must be sufficiently sensitive, to make possible the detection of reflected signals from various targets, including the earth, and moving aircraft. To these requirements, add that the fuze must be sufficiently rugged to perform perfectly after being fired at high accelerations from a weapon, be unaffected by temperatures encountered in the tropics or at very high altitudes such as are flown by modern aircraft, be capable of immediate use after prolonged storage—and, in meeting all these severe requirements, must be limited to a volume about the size of a man's fist. To top everything off, the fuze must be suited to mass production at low cost.

No one approach to such a requirement can be considered final; many approaches must be investigated to provide the optimum performance and economy, for millions of fuzes may be required to fight a war. These are some of the problems facing those conducting supporting research.

These fuzes, even more than those used fifteen years ago, must function properly. A high degree of reliability must be built into them. In the fuzing business there is no such

(*Continued on next page, col.* 3)

Disaster Planning

(*Continued from page 44*)

Safeguarding Classified Information

We are fortunate in having had a full-fledged security system in operation for a long time, because of the military nature of much of our business. Identification and screening of personnel, maintenance of closed and restricted areas, properly protecting classified data and guarding classified equipment are the order of the day, and, therefore, need not be provided especially for disaster purposes.

Continuity of Management

This brings us to the problem of management succession. This is not a problem with us because, as a part of our standard operating procedures, we have established and published delegations of authority pertaining to all divisional responsibilities. Therefore, in times of disaster, these delegations will conform to established lists of alternates who may act for their principals in the latter's absence. These, published in the Disaster Manual, will be supplemented by a list of alternates for the Zone Commanders. Alternates for Zone Commanders may be changed from time to time or handled on a rotating basis to broaden knowledge and interest in the disaster plan.

Control Centers

One room, located in a particularly safe, concrete-embedded section of the plant, is being equipped as a control center. It will serve as headquarters for the Disaster Council and the Security Manager; it will be equipped with maps, plotting boards, essential records, and communication equipment. It will be staffed as needed and serve as the principal assembly point of the emergency organization.

In addition, we plan to establish an off-site control center to use in the event the in-plant center is not accessible or in case the off-site center (which will be located away from the metropolitan target zone) can be reached more conveniently by top company officials. This center will be similarly equipped, and have duplicate personnel and other records, where practical.

These management-and-communication centers should go a long way to facilitate communication continuity of control, and resumption of operations, and at the same time leave many arrangements flexible for the discretion of the top operating executive in charge.

In order to make sure that this program will be kept alive and revised as needed, we have placed responsibility with the Security Manager for its maintenance and for keeping management apprised of developments. It is his responsibility to initiate needed capital authorizations and purchase orders, to see that the emergency organization is staffed, to schedule training sessions, to draft disaster procedures and so on.

Disaster planning is just another form of insurance and it should be appraised in those terms. Evaluation of the risk must be somewhat subjective. Each management must be the judge of how much its company must spend to protect itself against the eventuality of disaster. If disaster is a probability, then disaster planning is a responsibility industrial managements must consider.

Measuring Velocity of Underwater Sound

(*Continued from page 45*)

equal to the time which the received pulse spends below the noise level. This delay, which adds to the various circuit delays, depends on the attenuation of the liquid. For this reason, the velocimeter must be calibrated and used on the same or similar liquids. Since the attenuation characteristics of sea water are almost independent of salinity, the instrument may be calibrated in pure water for which the speed of sound is accurately known as a function of temperature.

The maximum rate of pulse rise at the receiver would normally be obtained with a straight path terminated by parallel piezoelectric crystals. However, under these conditions a system of multiple echoes exists in the water unless the path is inconveniently long. All echoes arising from a single primary pulse are self-synchronous; however, because of the circuit delays, they are not synchronous with those arising from any other primary pulse. These multiple echoes would interfere with the proper operation of the instrument.

To eliminate this effect, the pulse path is folded back on itself by means of a plane reflector which absorbs part of the energy of the pulse. Hard rubber and certain plastics are suitable materials for the reflector in the case of a 10-cm path. The use of the two-way path minimizes errors which arise from the mass motion of the water and also makes possible a more compact device.

The accuracy of the velocimeter depends mainly on the stability of the electrical circuits. In a typical case the time interval between successive sound pulses is about 70 microseconds. Of this interval, about 99 percent represents the time necessary for the sound pulse to traverse the path in the water; the remaining 1 percent represents electrical delay. For an over-all accuracy of 1 part in 5000, the electrical time delay must be held constant within 2 percent of its value over the entire range of environmental and operating conditions.

Actually the circuits in the velocimeter have been so engineered that the over-all stability in a static environment is about 1 part in 25,000. The method of calibration is reproducible to about 1 part in 10,000, and the expected variations in ambient temperature and supply voltages produce errors of about this same amount. On the basis of these various factors, the accuracy of the NBS velocimeter is estimated at about 1 part in 5000.

In recent performance tests, the NBS velocimeter has been used successfully to plot water temperature and salinity against depth in the Chesapeake Bay. The velocimeter can also be used as an underwater control device in other ocean studies.

Supporting Research in Fuze Development

(*Continued from page 48*)

thing as a "second attempt"; the fuze must function properly the first and only time it is used. Through the use of electronics, the fuzing of modern weapons is more reliable than ever before, and a good deal of the credit for this can be claimed by the men who "build the better mouse traps," the Supporting Research Laboratory, Diamond Ordnance Fuze Laboratories.

It should not be inferred from this article that this one laboratory is responsible for the fuzing of all weapons; on the contrary, virtually all of the actual fuzing tasks which are assigned to DOFL are done by the Projectile Fuze Laboratory, the Electromechanical Laboratory, or the Guided Missile Laboratory. These Laboratories, articles on which will be forthcoming, have the direct responsibility for developing fuzes for the Armed Forces' non-rotating projectiles and missiles. The Supporting Research Laboratory handles only those situations in which new types of fuzing systems or components are involved, or for which a large amount of research into new fields is required.

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Association Affairs

1956 CONVENTION PLANS PROGRESS

David R. Hull, chairman of the 10th Annual AFCEA Convention, has held several meetings with his committee during the winter months to make further plans for the 1956 national convention to be held May 24, 25 and 26 in Boston.

In addition to Captain Hull, officials for the convention are: deputy chairman—Raymond B. Meader, Raytheon; secretary-treasurer—Paul F. Hannah, Raytheon; coordinator—John S. Spargo, William C. Copp & Associates; program—Frank Lyman, Jr., Cambridge Thermionic; public relations—Jack L. Hobby, Raytheon; banquet—Fred E. Moran, Western Union; tours and transportation—Arthur S. Mullins, New York Central Railroad; hospitality—Dan Greene; reservations and registration—Capt. J. H. Reego, ROTC Instructor, Northeastern University; student chapter support—Capt. F. D. Stevens, ROTC Instructor, Northeastern University. The ladies program is being arranged by Mrs. Gardiner G. Greene, wife of the Boston Chapter president.

At one of the recent meetings, the theme for the convention was selected. The committee, in conjunction with AFCEA President George W. Bailey and Executive Vice President George P. Dixon, decided to center the convention around the meaning of the Association in order to reemphasize to the members the purpose of the organization. The theme is "Military and Industry—Partners in Progress."

The program includes two symposiums. After the Keynote Luncheon on Thursday, the 24th, a symposium on research will be held. On Friday afternoon, a panel will speak on business and military relations. Speakers for the entire convention program will be announced in the February Newsletter.

Companies Accepted for AFCEA Group Membership Since November 1, 1955

†American Telephone & Telegraph Co., Long Lines Dept.
New York, New York

*Blackburn Electronic Corp.
Wyoming, Pennsylvania

†Burroughs Corp.
Detroit, Michigan

†Convair, Division of General Dynamics Corp.
Pomona, California

†Fairchild Camera & Instrument Corp.
Syosset, New York

†Hycon Eastern, Inc.
Cambridge, Massachusetts

*Peninsular Telephone Company
Tampa, Florida

†Standard Engineering & Manufacturing Co.
Long Branch, New Jersey

*Brief notes about these companies appear on this page.

†Brief notes about this company will appear in the March-April issue.

620 new AFCEA individual members from November 1 to January 1

Introducing AFCEA's New Group Members

Barker and Williamson, Inc.

A recent addition to the group members of the Association is Barker and Williamson of Upper Darby, Pennsylvania, radio manufacturing engineers.

The following members of the firm have been designated to be company representatives in the AFCEA: Barrie R. Barker, president; John F. Williamson, vice president; John E. Gillmor, vice president-treasurer; Robert B. Keiser, assistant secretary; James C. Pearce, vice president, Engineering Sales; Rafael Cleveland, assistant vice president, Engineering Sales; Arthur M. Lesley, chief engineer; Jack N. Brown, consultant on equipment development; Joseph Diliberto, purchasing agent, and Julius C. Buzzelli, factory manager.

Blackburn Electronic Corporation

The AFCEA welcomed as a new group member in November, Blackburn Electronic Corporation of Wyoming, Pennsylvania.

Serving in the Association as company representatives will be Herbert K. Blackburn, president; Edward A. McQuoid, vice president and general manager; James C. Muggleworth, vice president and secretary; Harry E. Myers, engineering manager; Elwood H. Blackburn, assistant secretary; Warren Scanlan, engineer; Donald S. Roselle, engineer; Charles Knopp, engineer; William Hizny, inspector, and John Anzalone, supervisor.

Peninsular Telephone Company

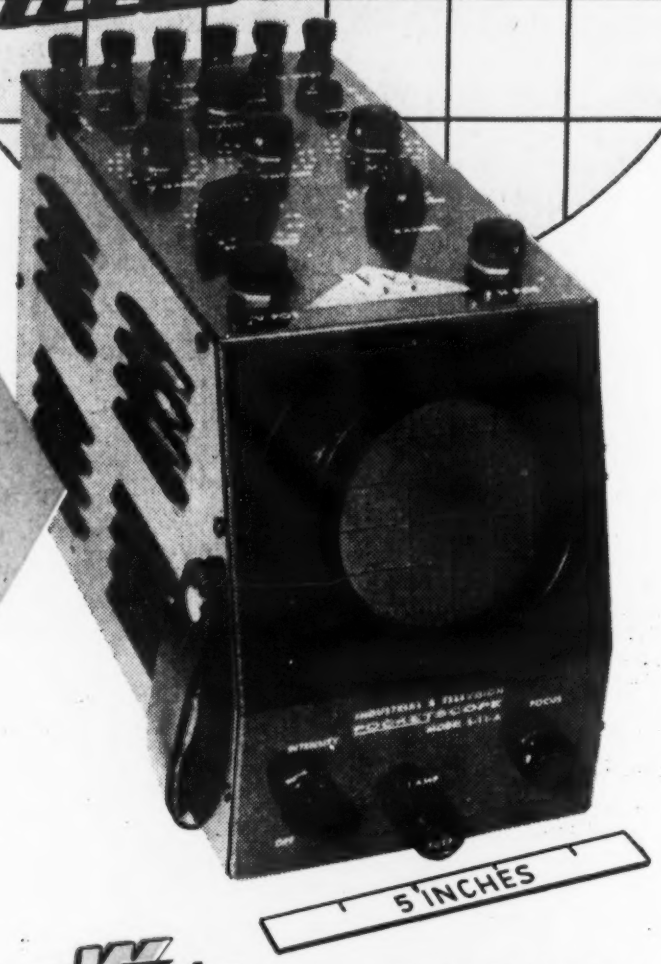
The Peninsular Telephone Company of Tampa, Florida, joined the AFCEA in November.

The following have been designated by the company to be AFCEA mem-

(*Continued on next page, Col.* 3)

INDUSTRIAL POCKETSCOPE

by Waterman



ANOTHER EXAMPLE OF Waterman PIONEERING...

The INDUSTRIAL POCKETSCOPE, model S-11-A, has become America's most popular DC coupled oscilloscope because of its small size, light weight, and unique flexibility. This compact instrument has identical vertical and horizontal amplifiers which permit the observation of low frequency repetitive phenomena, while simultaneously eliminating undesirable trace bounce. Each amplifier sensitivity is 0.1 Volt rms/inch. The frequency responses are likewise identical, within —2 db from DC to 200 KC. Their total undistorted outputs permit effective trace expansion of twice the screen diameter. The internal sweep generator is continuously variable from 3 cycles to 50 KC and can be synchronized from positive going signals. Return trace blanking is optional. Intensity modulation is accomplished by connecting either directly to the grid of the three-inch cathode ray tube or thru an amplifier having a gain of approximately 10 and a flat response to 500 KC. Direct intensity modulation threshold voltage is approximately 1 volt rms. Additional provisions for direct access to all the deflection plates, the second anode, and the amplifier output terminals extend the usefulness of the S-11-A many fold.

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New AFCEA Chapters

North Carolina

Application for charter for the North Carolina Chapter was received and approved in December. The chapter was organized through the efforts of Colonel Henry J. Hort, Signal Officer, Headquarters, 1st Logistical Command, Fort Bragg, who was once president of the Association's Augusta-Camp Gordon Chapter.

Temporary chapter officers have been chosen as follows: president—Lt. Col. Don C. Benjamin, CONARC Board #5, Fort Bragg; 1st vice president—Luke W. Hill, President, Carolina Telephone & Telegraph Co., Tarboro; 2nd vice president—Joseph E. Howell, Chief Engineer, Radio Station WTSB, Lumberton; secretary—Maj. Warren S. Bell, Psychological War Center, Fort Bragg; treasurer—T. P. Williamson, Manager, Carolina Telephone & Telegraph Co., Fayetteville.

Rome-Utica

Chartered in November, the Rome-Utica Chapter has its headquarters at Griffiss Air Force Base. Elected president is Robert A. Rodriguez of the Rome Air Force Depot, whose initiative and hard work was responsible for the formation of the chapter.

The other officers are: 1st vice president — Allan A. Kunze, Rome Air Development Center; 2nd vice president — John Regan, Westinghouse Electric Corp.; secretary — Darrell S. Kirby, RADC; treasurer —Maj. Stanley J. Wisniewski, RADC.

Plans were discussed for various chapter activities and committees were appointed as follows: membership—E. B. Darnall, chairman; program—Allan A. Kunze, chairman. Capt. H. E. Frazer and E. B. Darnall; constitution and by-laws — Charles Strom and A. D. Reisenberg.

SMOKE SIGNALS
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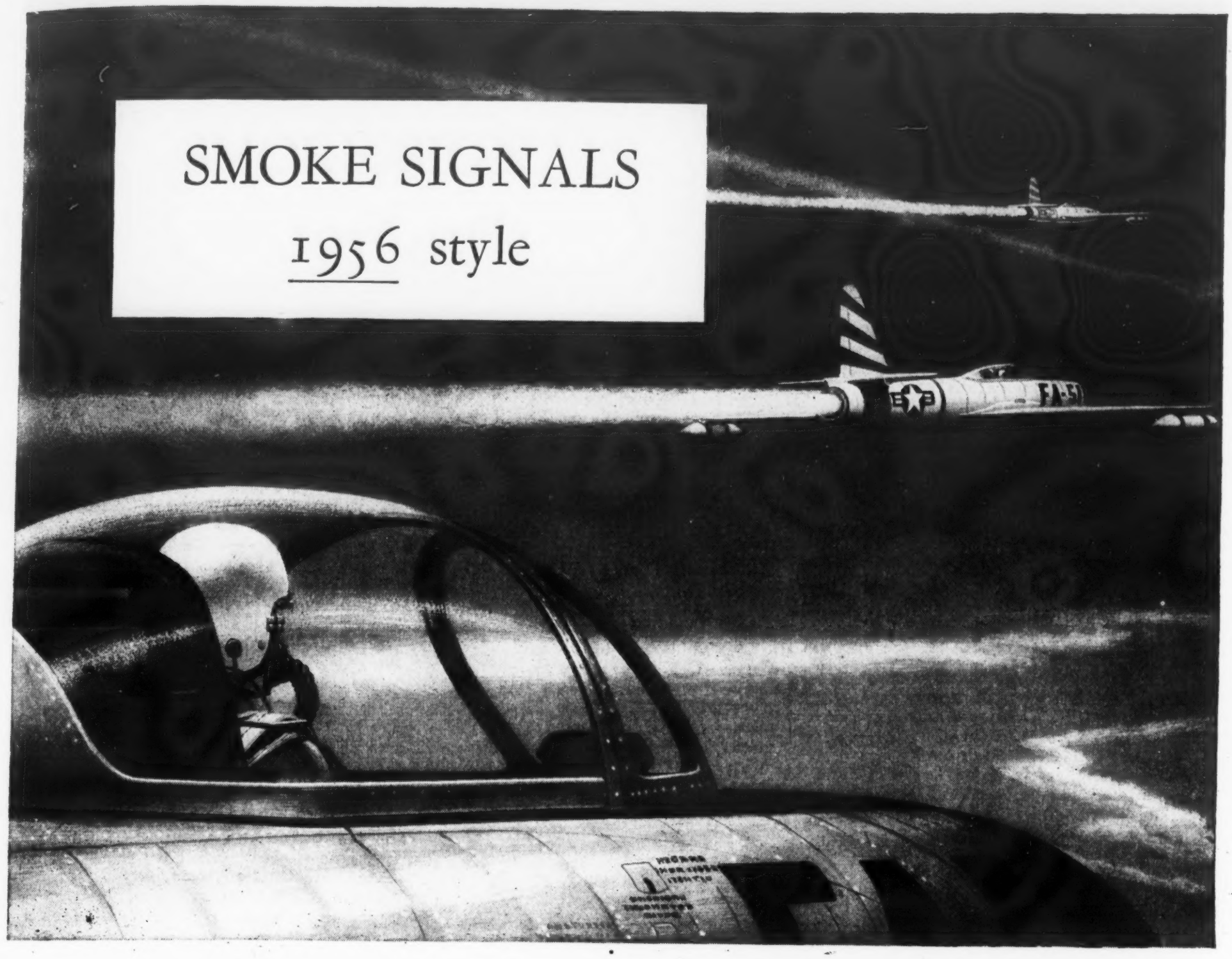

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Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

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Allied Control Co., Inc.
Allied Radio Corporation
Almo Radio Company
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Bell Telephone Laboratories, Inc.
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Cornell-Dubilier Electric Corp.
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DeVry Technical Institute
Diamond State Telephone Co.
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Federal Telephone & Radio Corp.
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International Resistance Co.
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Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Kay Lab
Kellogg Switchboard & Supply Co.
Keystone Electronics Co.
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Librascope, Inc.
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Maida Development Company
Mallory, P. R., & Co., Inc.
Marion Electrical Instrument Co.
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Michigan Bell Telephone Company
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Montgomery Company, The
Motorola, Inc.
Mountain States Tel. & Tel. Co.
Mullard Ltd.
Muter Company, The
Mycalex Corporation of America
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New Jersey Bell Telephone Company
New York Telephone Company
North Electric Company
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
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Radio Corporation of America, Engineering Products Division
Radio Engineering Laboratories, Inc.
Radio Frequency Laboratories, Inc.
RCA Photophone, Ltd.
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Raytheon Manufacturing Company
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From the first sketch to the final, super-accurate mechanism, Philco pioneered and completed this assignment in cooperation with the Navy. Philco's world famous scientific knowledge and skill is a continuing factor in the development of tomorrow's defense for your protection . . . tomorrow's quality products for better peacetime living throughout the world.

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Chapter News

Chapter of the Year—South Texas

Baltimore Chapter members were guests of the CAA at Friendship International Airport on October 18th. Above, Colonel George Dixon addresses the dinner-meeting which preceded the evening's program.

Augusta-Camp Gordon

The Chief Engineer for the city of Augusta, Mr. "Country" Crawford, was guest speaker at the chapter's October 20th meeting. With "Emergency and Service Communications for a Modern Community" as his topic, Mr. Crawford outlined the communication systems employed by Augusta's fire and police departments and the cooperative efforts of the city and civil defense groups.

The program for the November meeting was presented by Col. William D. Harden, USMC Res., who spoke on "413 Years in the Development of Firearms." A collector of firearms, Colonel Harden illustrated his talk with numerous pieces from his fine collection.

The annual election of officers took place at this meeting, with J. C. Woodward, Jr., chosen as the new president for 1956. The other new officers elected are: honorary presidents — Brig. Gen. Ralph T. Nelson, commanding officer, Signal Corps Training Center; and Col. Otto T. Saar, retiring chapter president; vice presidents — Col. George W. Rhyne, SCTC; Francis A. Saxon, Georgia Power Co.; Lt. Col. Bertie L. Avera, TSESS; secretary— Walter B. Neeley, Southern Bell T&T Co.; treasurer— Maj. Elmer F. Gahnz, TSESS.

Board of Directors for 1956 are: Col. Lowrey R. Moore, Camp Gordon; Col. William D. Harden, attorney; Jewett M. Harris, Western Union; Col. Braxton E. Small, Camp Gordon; Maj. Charles Picciuolo, TSESS; Edward G. Coursey, Graniteville Co.; Maj. John D. Hartline, TSESS; and Thomas M. Baker, Southern Bell T&T Co.

Mr. W. O. McDowell, 1954 chapter president, and Colonel Saar were chosen to represent the chapter on the National Council.

President Saar announced that Lt. Col. Stephen S. Furse, chapter secretary, was retiring from the Service and moving to Atlanta, and expressed the chapter's appreciation for Colonel Furse's active participation and interest in Augusta-Camp Gordon Chapter affairs. Major Karl E. Root, Hq. Co. TSESS, was appointed to serve as secretary for the balance of the year.

Baltimore

The Civil Aeronautics Administration was host to the chapter at Friendship International Airport on October 18th. Special guests were Silas F. Clark, Chief of the Electronics Branch of the Airways Engineering Division, Office of Federal Airways; A. Ashley, Chief of the Facilities Maintenance Branch at the New York International Airport; and Ernest L. Gayle, Chief of the Radar Engineering Section at the New York International Airport.

Mr. Ashley gave a brief resume of the CAA and pointed out that aviation ranks second in employment in industry. He cited some interesting figures on air travel, stating that 30,000,000 individuals ride the air lines, and that there are 6,000 airports and over 70,000 miles of airways equipped with air navigational aids.

The operation of an air surveillance radar was shown on slides and film, after which the members visited the Airport Control Tower and the Weather Bureau.

During the dinner-meeting, Col. George P. Dixon, Executive Vice President, addressed the chapter on national AFCEA affairs.

The November 15th meeting was held at the Friez Instrument Division plant of the Bendix Aviation Corporation. Highlight of the program was a sound and color film of the 1954 National Aircraft Show which featured a helicopter square dance, jet planes breaking the sound barrier and some of the modern aircraft in the nation's defense arsenal.

Following an introductory talk by Col. LeRoy D. Kiley, Bendix-Friez general manager, the AFCEA group was conducted on a tour of the plant facilities.

Boston

Representatives of the group member companies in the Boston area were guests of the chapter on November 16th at the Boston Navy Yard. After a social hour and dinner, the attendance of sixty members heard brief reports of the activities of the various companies.

Invitations went out to all presidents of group member companies in the New England area and the chapter was gratified by the large number who either attended or sent a representative. Among those present were: Irving Pietz, President, Barry Controls Corp.; Richard Frost, President, Holtzer-Cabot Division, National Pneumatic Co.; A. Coblenz, Assistant to the President, Transistor Products Co.; William Jones, Vice President, Control Engineering, Department of Detroit Controls Corp.; Frank Lyman, Jr., President, Cambridge Thermionic Co.; J. H. Zimmer, Manager, Western Electric Co.; Fred Moran, Superintendent, Western Union Telegraph Co.; and Milton Alden, Chairman, Alden Elec-

Boston's November meeting featured the chapter's group members. Seated at the head table (l to r) are: A. Coblenz, Transistor Products Co.; Fred Moran, Western Union Telegraph Co.; J. H. Zimmer, Western Electric Co.; Frank Lyman, Jr., Cambridge Thermionic Co.; Gardiner Greene, chapter president; William Jones, Department of Detroit Controls Corp.; Irving Pietz, Barry Controls Corp.; Milton Alden, Alden Electronic and Impulse Recording Equipment Co., and Richard Taylor, program chairman.

Guide words for today—

"General MacArthur has said that in war there is no substitute for victory. The record of Korea certainly justifies that conclusion. The broader struggle in which we are now engaged, however, is not entirely a battle of guns and ships and aircraft. We are in a world conflict with Communism, one presently being fought with threats of force, with ideologies, diplomatic maneuverings, and economic pressures. It is a fight to the finish. In it, there will be no substitute for victory; either the darkness of Communism will engulf the world, or the banner of freedom will fly over all lands."

ADMIRAL C. TURNER JOY

There is perhaps no one who has a more practical knowledge of Red negotiating tactics than Admiral Joy. For 11 months he sat across the conference table from the Communist negotiators in Korea. He has seen first hand their doubledealing and treachery . . . and has stated that there is but one factor which the Communists universally respect: "naked, massive power." Let us hope Admiral Joy's words will not go unheeded by our well-intentioned negotiators who still hope to bring about peaceful co-existence.

W B Stuart
President

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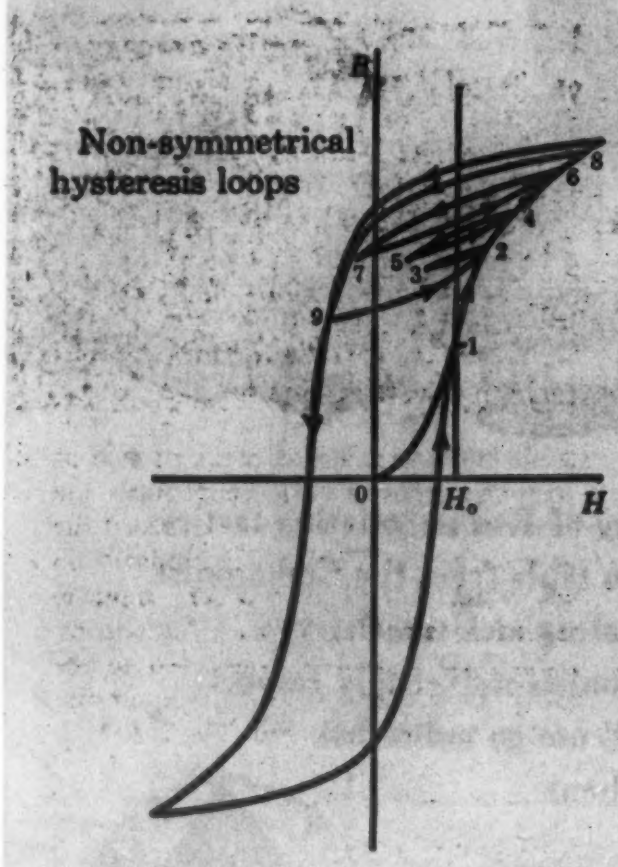

■ Close performance specifications depend, of course, on methods of core design and testing procedure. We have prepared organized engineering data presenting incremental permeability as applied to audio transformer cores which will provide you with valuable reference material. Ask for Bulletin A8.

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CHAPTER NEWS

tronic and Impulse Recording Equipment Co. During the meeting each outlined the product and activities of his company, gave an interesting preview into its future plans, and told how their work had led them into becoming group members of the Association.

A progress report on the plans for the 1956 Annual Convention was submitted by Raymond B. Meader, deputy chairman of the convention committee.

Chicago

The Chicago Regional Office of the Signal Corps Supply Agency sponsored a dinner meeting on October 27th. Colonel A. N. Niemi, Commanding Officer, was host to the chapter members and guests. Old timers report the attendance of 238 established a record for Chicago Chapter meetings.

Major General W. Preston Corderman, Deputy Chief Signal Officer, was guest of honor and principal speaker, delivering an excellent talk on trends in automation as applied in the Signal Corps. (See "Quotes in Review," page 37.)

Colonel Niemi briefly explained the mission and function of the Chicago Regional Office as related to the Signal Corps Supply Agency. Subsequent to the dinner and program, members of industry were encouraged to visit the actual work points throughout the Chicago Regional Office where key personnel were available to discuss problems with industry personnel.

Dayton-Wright

Brigadier General Thomas L. Bryan, Jr., Commander of the Wright Air Development Center and past president of AFCEA's Tinker-Oklahoma City Chapter, was the principal speaker at the November 3rd dinner-meeting.

The Wright Air Development Center, located at Wright-Patterson Air Force Base, is one of ten major research, development, and test installations maintained throughout the country by the Air Research and Development Command. Discussing the Air Research and Development Command's weapons system concept, General Bryan pointed out that the complexity of present-day aeronautical equipment and the length of development time involved demands a positive systems approach to the creation of air weapons. "To produce a modern aircraft with its thousands of intricate parts all integrated into an effective instrument of combat requires the most careful planning and most sound management," he explained.

General Bryan announced that recently two Deputy Commander positions had been created within WADC's organizational structure—one for Research and the other for Development. He added that sometime after the first of the year, an Operational Development Division would be established within the newly-named Directorate of

CHAPTER NEWS

Northeastern University Student Chapter delegation shown at a recent meeting of the Boston Chapter with, left to right: Gardiner Greene, Boston Chapter president; George W. Bailey, National President; William C. Copp, national advertising representative; Raymond B. Meader, co-chairman, 1956 convention; George P. Dixon; Fred Moran, Boston vice-president; David R. Hull, convention chairman. The student chapter members are, l to r: Melvin Wartel, Harvey Glass, James Manning, Stanley R. Swartz, Charles Smith, and Capt. F. D. Stevens, advisor.

Development, which will be the Center's central staff agency for managing workload requirements insofar as weapons systems are concerned. "Staffed by a small but highly competent group of technical people, the new Division, as a single unit, will be capable of speaking for all our individual technical laboratories on all matters pertaining to WADC's support of weapons system requirements," General Bryan pointed out. He concluded by stating that "through this organization and management concept, we hope to provide the integration and direction we consider vital to the development of the qualitatively superior weapons systems this nation must have to maintain its security."

The dinner-meeting was held at the Officers Club, Wright-Patterson Air Force Base, and was preceded by an industry-sponsored cocktail party. One hundred and sixty-two members and guests were present.

A luncheon-meeting at the Van Cleve Hotel on November 30th was addressed by Robert C. Clark, public relations supervisor for the Ohio Bell Telephone Company, Cleveland.

In his demonstration talk Mr. Clark explained the principles of microwaves in the transmission of television pictures from point to point without the aid of wires, and showed how microwaves can be reflected, bent, made to go around corners and concentrated into narrow beams. He also explained how microwave transmission is fast replacing coaxial cable for inter-city long distance telephone connections.

Decatur

The chapter held its October meeting on the 27th in the Officers' Club of the Decatur Signal Depot. A special program for the evening was presented by the Motorola Company and included a demonstration of "Transistorized Paging Systems." Motorola engineers F. Harmon Seaver, Leo Koltz and Russ Rennaker conducted the program.

Colonel Edwin G. Fritz, chapter president and commanding officer of the depot, brought as his special guest,

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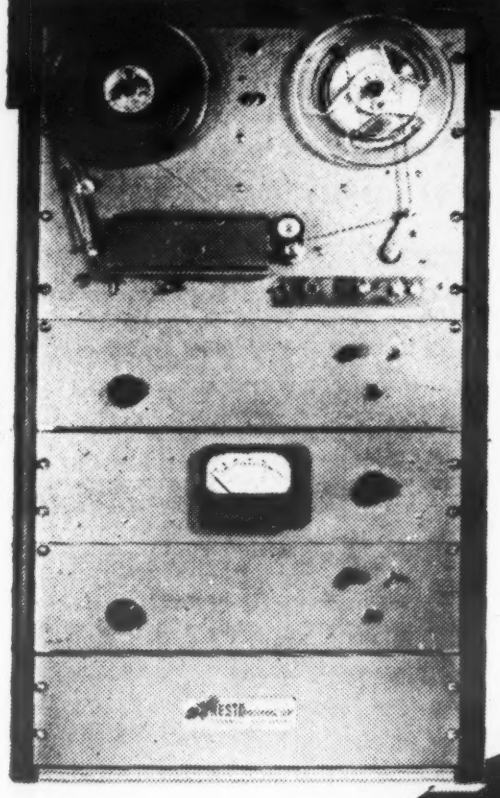

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CHAPTER NEWS

Mr. J. Lewis Powell from the Office of the Assistant Secretary of Defense.

Refreshments were served at the conclusion of the meeting. There were sixty-six members and guests in attendance.

A visit to the Federal Civil Defense Message Center in Decatur was the feature of the November 17th meeting. Colonel Arnold, in charge of the center, welcomed the chapter and detailed Federal Civil Defense activities in Macon County. The members and guests were then conducted on a tour which included various demonstrations of equipment.

Fort Monmouth

"Reliability of Electronic Equipment," a subject of foremost importance in the communications and electronics fields was discussed by Barry Carlton, General Manager of the Government and Defense Division of the Magnavox Corporation, at the October 27th chapter dinner-meeting. The Sapphire Room at Gibbs Hall Officers Club was filled to capacity for the occasion.

Mr. Carlton was well qualified to present an authoritative discussion on this subject. He was formerly the Coordinator of Reliability for the Department of Defense and had served as a member of the Advisory Group, Reliability of Electronic Equipment.

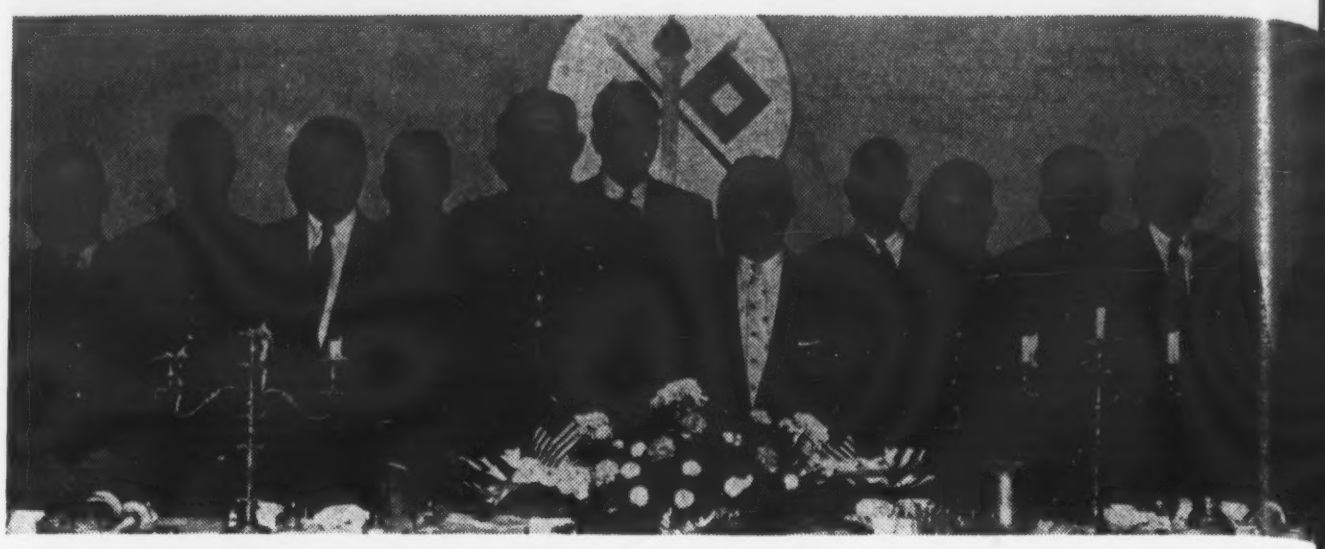
The chapter's annual elections were held on November 17th, with Colonel Fred J. Elser of The Signal School chosen as president.

The other new officers elected to serve during 1956 are: first vice-president—Arthur Adamson, Electronic Associates, Inc.; second vice-president—Dr. E. G. Witting, Signal Corps Engineering Laboratories; secretary — Lt. Col. Nell E. J. Farnham, The Signal School; treasurer — Mrs. Esther M. Ipri, Fort Monmouth.

The new board of directors includes: Col. John C. Monahan, retiring president; Col. Olin L. Bell, Fort Monmouth; Lt. Col. Oscar C. Buser. TSS, retiring secretary; William Christopher, Sylvania Electric Products; Col. Joseph E. Heinrich, AT&T Company Long Lines; J. Peter Hoffman, public and technical information, Hqs. Fort Monmouth; Edward F. Kolar, Bendix Aviation Corp., Red Bank Div.; William S. Marks, Jr., SCEL; Norman J. Schwartz, Heineman Electric Co.; RAdm. Andrew G. Shepard, Lavoie Laboratories; Col. Robert B. Tomlinson, SCEL, and George Trad, Trad Television Company.

Thomas R. Schlitz, an instructor in The Signal School, was appointed membership chairman by the new president.

Principal speaker at the dinner-meeting was Major General Emil Lenzner, Commander, Army Electronic Proving Ground, Fort Huachuca.



Chicago's meeting at the Regional Office of the Signal Corps Supply Agency. L to r: Col. LeRoy C. Lewis; Col. Malin Moody; William Halligan, Sr.; Lt. Col. E. R. Murphy; Maj. Gen. W. Preston Corderman; James Kellogg; Raymond K. Fried, chapter president; Capt. L. P. Kimball, Jr.; Col. A. N. Niemi; Maj. T. R. Pitts; Carrington Stone, and Frank C. Meade.

Geneva

The November meeting of the Geneva Sub-Chapter was a luncheon at the Hotel du Rhone on November 26th.

Various items of business were discussed, including program plans for the coming year. In view of the fact that the chapter membership has grown from the original five members to the fifteen required to form a regular chapter of the association, it was decided to apply to national headquarters for a charter as a regular chapter of the AFCEA. Presently the chapter is chartered as a sub-chapter of the Paris Chapter.

Chapter President John H. Gayer presided over the meeting.

Kansas City

The chapter inaugurated its first annual holiday party on December 2nd. Held at the Grandview Air Force Base Officers' Club, the evening's program consisted of a cocktail party, buffet supper and dance. Its fine success will probably make it a traditional chapter affair each year.

London

One hundred and thirty-four members and guests attended the October 6th meeting at the London Airport Central, advance report of which appeared in November-December SIGNAL.

During the dinner Brig. Gen. S. M. Thomas, chapter president, introduced the 1955-56 officers and reported that the membership drive was showing excellent progress. He congratulated Lt. Col. Norman E. Fertig, chairman of the membership committee, who had presented applications for thirty-three new members on arrival at the meeting.

Following the tour of the London Airport communications facilities which was conducted by Squadron Leader W. P. Nichol, Senior Signals Officer with the Ministry of Transport and Civil Aviation, and Mr. Manley, Senior Air Traffic Control Officer, the chapter heard an illustrated discussion on TACAN by Mr. W. L. Garfield of Standard Telephones and Cables, Ltd.

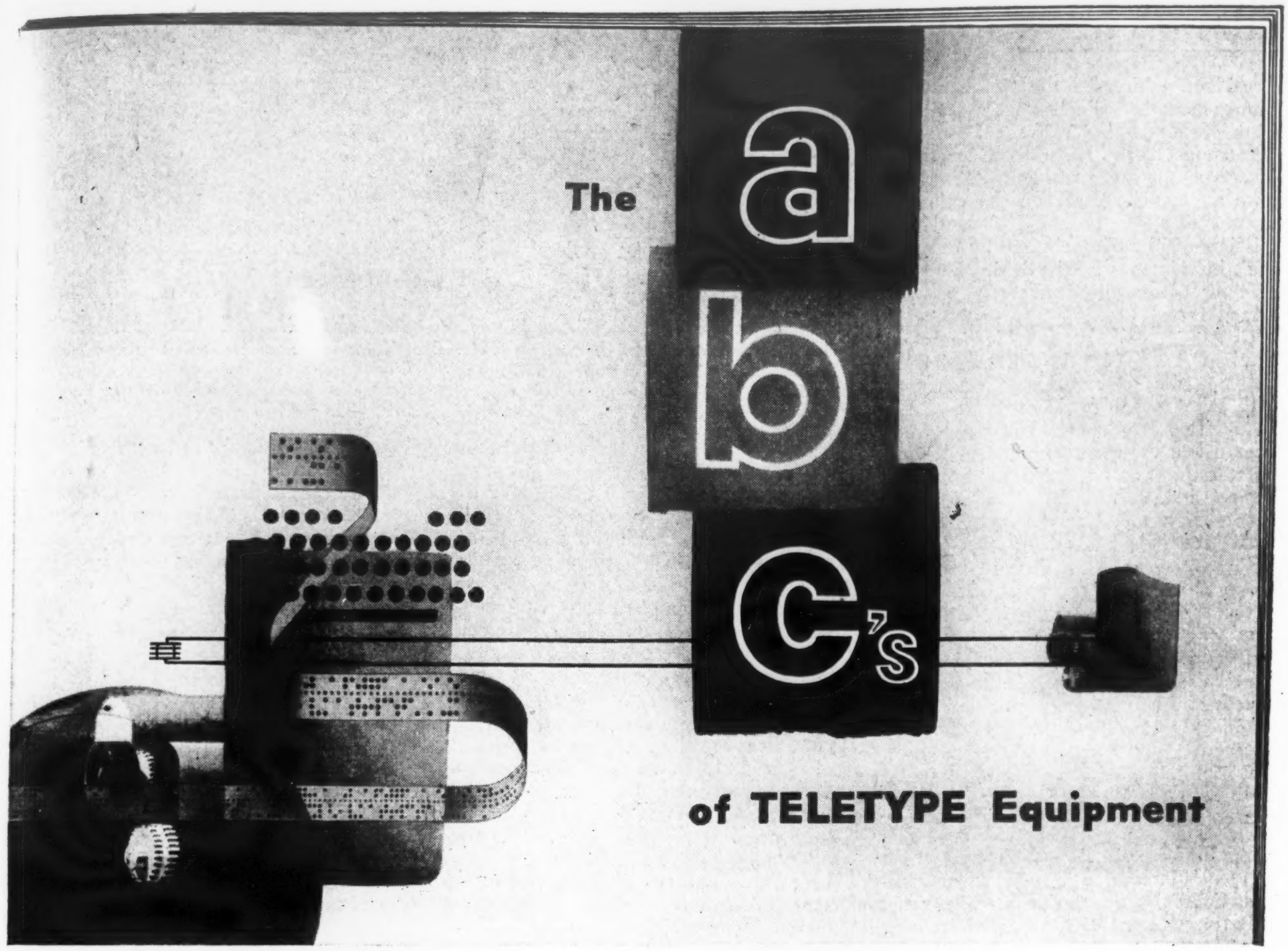
Of special interest to the chapter was the presence of Commander C. G. Mayer, USNR, 1954-55 president, who flew over from Switzerland for the occasion.

Among the new members of the chapter is President Thomas' son. 1st Lt. Samuel W. Thomas, Jr., USA.

Dayton-Wright's November meeting was addressed by Brig. Gen. Thomas L. Bryan, Jr., Commander, Wright Air Development Center. Shown with General Bryan is Robert J. McIlrath, chapter president

Montgomery

Ralph S. Grist, General Coordinator of Military Services, Southern Bell Telephone and Telegraph Company at Atlanta and AFCEA Regional Vice-



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CHAPTER NEWS

President, addressed the October 27th dinner-meeting, held at the Officers' Club of Maxwell Air Force Base.

Introduced by Lt. Col. George D. Meserve, chapter president, Mr. Grist gave an inspiring talk on the value of membership in the AFCEA and the mission of the Association in cementing the bonds of friendship between communicators in industry and the armed forces.

Guests at the head table included Paul Grist, YMCA Director from Selma, Ala.; Jack Conley, Assistant Military Coordinator, Southern Bell; Lyle Hinds, Commercial Manager and Scears Lee, Assistant Commercial Manager, Montgomery Office, Southern Bell; Col. Robert W. Griffin, DC/S Communications-Electronics, Air Command and Staff College; Col. James W. Heuer, Air War College, and Lt. Col. Peter D. Green, president of the present class of Command and Staff Course.

During the social hour which followed the meeting, many old acquaintances were renewed and new ones made.

New York

Attention was focused on the DEW Line, or Distant Early Warning System, at the October 26th meeting, with Col. Vernon B. Bagnall, DEW Line Project Manager of the Western Electric Company presenting an illustrated talk on this recently-revealed defense measure.

Colonel Bagnall discussed the events leading up to the present installation of the system in the Arctic regions and showed for the first time a recently declassified motion picture depicting the loading and unloading operations and construction of the first experimental bases in the Arctic. He also pointed out some of the lessons learned from these first operations. Colored slides showed the many difficulties and hazards in the construction of these bases because of climatic and terrain conditions, and they also showed the enormous scope of the project.

This chain of specially-designed radar and communication stations across Alaska and Canada has been designed to provide immediate warning of any approaching aircraft. Many of these bases are unattended and it was necessary to develop unique construction methods and facilities to withstand the Arctic cold and storms. The DEW Line is the most northerly defense outpost and is backed up by the Mid-Canada and Pinetree lines.

The three Services cooperated in this joint effort with many civilian contractors under the general supervision of the Western Electric Company. Colonel Bagnall stated that over 3,000 men and a large number of airplanes participated in the special air and sea lifts which took place during the period of June-July 1955 when over 200,000 tons of cargo were hauled to the various DEW Line bases.

The dinner-meeting was held at the Belmont Plaza Hotel, with a social hour preceding. Among the guests at the head table was Mr. John V. L. Hogan who was recently awarded the IRE 1955 Medal of Honor.

At the November 30th meeting, Mr. C. C. Duncan, General Manager of Special Projects, Long Lines Department, American Telephone and Telegraph Company, presented a fascinating account of the laying of the first transatlantic telephone cable.

With the aid of color slides, Mr. Duncan told the full story of this historic cable project which, when completed, will provide a 36-channel voice path between North America and the United Kingdom. His talk also included a discussion of the cable route selection together with an explanation of some of the manufacturing problems and methods of laying cable in both deep sea and inshore locations.

Mr. Duncan had available for the members' inspection a "mock-up" of the submarine repeater, the special vacuum tubes and samples of the cables used. He also distributed copies of the AT&T publication "Transatlantic Cable Puts Out to Sea."

Decatur Chapter's October meeting featured a Motorola demonstration. Left to right are: Lt. Col. Jack E. Willis, Deputy C.O., Decatur Signal Depot; Col. Edwin G. Fritz, Chapter President; J. Lewis Powell, Office of Asst. Secretary of Defense, and Motorola engineers F. Harmon Seaver, Leo Koltz and Russ Rennaker.

Fort Monmouth's newly elected officers appear above, l to r: Mrs. Esther Ipri, treasurer; Arthur Adamson, 1st vice-president; Col. John C. Monahan, retiring president; Col. Fred J. Elser, new president; Dr. E. G. Witting, 2nd vice-president, and Lt. Col. Nell Farnham, secretary.

Fort Monmouth Chapter entertained several prominent guests at its November meeting. Seated, l to r: Brig. Gen. Earl F. Cook, SCEL; Maj. Gen. Emil Lenzner, AEPG, principal speaker; Col. Monahan; Col. Joseph E. Heinrich; and Maj. Gen. Carlos Marin de Bernardo, Chief Signal Officer of the Spanish Army; standing, l to r: Col. Cary King, Capt. Chris Engelman and Dr. Douglas Ewing.

North Texas

Chapter members became better acquainted with the mammoth job of Signal Corps supply and maintenance after a tour of the Fort Worth General Depot on October 31st. The depot is responsible for the supply and storage of Quartermaster and Signal supplies and equipment in the Fourth Army area.

Playing host, the depot members showed the chapter how equipment enters the depot in various stages of disrepair, is broken down to its smallest component, rebuilt and returned to

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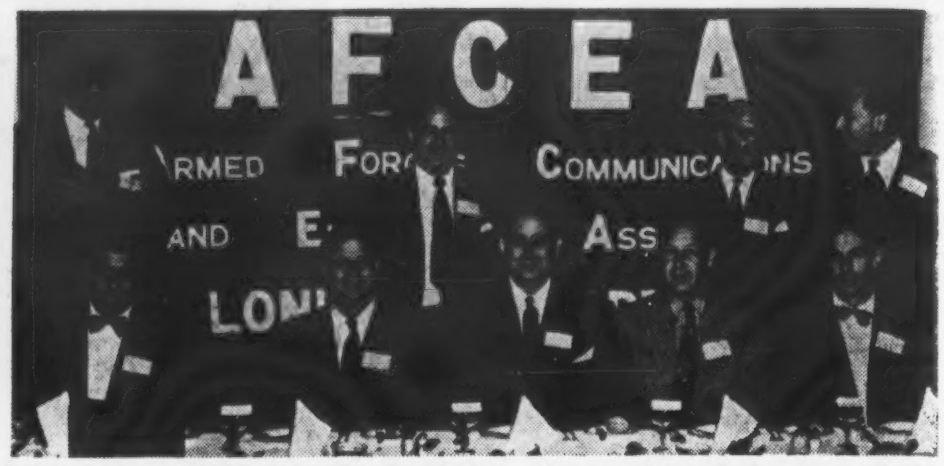

London Chapter's visit to the London Airport Central. Photo at left shows, l to r: Sqdn. Ldr. W. P. Nichol, who conducted the tour of the communications facilities; Vice Adm. (Ret.) J. W. S. Dorling; Capt. H. E. Ruble, USN; Capt. Lennox-Cunningham, RN. Chapter officers appear in photo at right (l to r): seated, Lt. Col. N. Fertig, 3rd VP; Capt. H. P. Rumble, 1954 VP; Brig. Gen. S. L. Thomas, president; Capt. H. E. Ruble, 1st VP; and Maj. R. C. Foss, secretary. Standing: Capt. E. Metzger, program chairman; Cdr. C. G. Myer, 1954 president; P. A. Turnor, assoc. treasurer; and L. T. Hinton, assoc. secretary.

stock for subsequent issue to the field. The tour included a look at the tremendous task of receiving equipment from manufacturers and Army posts and camps, storing, packaging and shipping. An average of 105,879 tons of supplies are in storage each month at the depot.

Executive Vice President George Dixon was guest speaker at the chapter's November 14th meeting, also held at the Fort Worth General Depot. Colonel Dixon reviewed the history of the Association from its early days to the present, and reported on the growth of its chapters throughout the country and overseas. He also presented an up-to-date report on the current plans and objectives of the Association.

The chapter members and guests were welcomed to the depot by Colonel Silver, post commander, who also extended an invitation to hold future chapter meetings at the post.

A buffet dinner preceded the meeting, with some seventy members and guests present.

Philadelphia

Over 140 members and guests attended the initial Philadelphia Chapter meeting on October 13th. Following cocktails and dinner at Schraffts Restaurant, Chapter President Jack Barkow of RCA introduced the other 1955-56 officers and outlined plans for chapter activity during the coming year. Guest for the evening was Col. George P. Dixon, Executive Vice President, who also addressed the group and discussed national Association affairs.

The members and guests were then transported via chartered bus to the Franklin Institute where they were conducted on an extremely well-planned tour through a series of impressive exhibits sponsored by the Bell System.

Expanding on the theme that "your telephone reaches everywhere," the exhibits portrayed the extensive channels of wire and cable, covering the miles with today's giant strides of radio relay. The group viewed the automatic message accounting system—newest advance in telephone service—which records the number called, time, date and length of talk on Braille-like perforated paper tape. Fast and accurate, this system sorts out the calls and prepares the bill for each subscriber. Through the use of individual instruments, the AFCEA visitors listened in on a time check in California which was dialed direct and connected in a matter of seconds.

Another display illustrated the extent of telephone service to every "civilized" spot on the earth, and the anticipated durability of transatlantic cables.

For defense, one exhibit demonstrated the warning network of radar, the intricate electronic brains, the guided missile, the lightweight weatherproof telephone and switchboard for the field soldier, and the control centers and communications services to link them all together—all the outgrowth of Bell Laboratories' research. Also discussed and exhibited were the "Mighty Midget" transistor's role in the telephone system, the Bell Solar Battery, and modern telephone advances for everyday use including a "hands free" unit, an automatic telephone answering and recording set, automobile sets, and a simple button amplifier for volume as required.

Pittsburgh

The chapter received an invitation to inspect Western Electric's new distribution house on October 5th and, despite a heavy downpour, sixty members made the trip. The evening's program included a detailed tour of the new warehouse and repair center.

The members were divided into small groups, each with a guide who explained the various steps in the assembly, repair and supply operations. The automatic selective conveyor system and the innumerable small items necessary to supply the Bell System demands were most impressive.

Following the tour, refreshments were served in the company cafeteria.

Rome (Italy)

A lecture-demonstration on the "General Use of Electronic Digital Computer FINAC" was presented by the Rome Chapter on October 4th at Consiglio Nazionale delle Ricerche, Piazzale delle Scienze, Rome.

Messrs. B. Robinson and O. M. Ephraim, engineers of Ferranti Ltd., Manchester, England, conducted the program.

Subjects of other lectures recently featured at chapter meetings were: "Beam Rider Missile Guidance System," presented by T. Bonetti, engineer with Contraves Italiana, AFCEA associate group member company; and "Automatic Teletype Switching Control," delivered by Frank C. Chevalier, managing director, International Automatic Electric Sales Company.

Sacramento

On November 14th, chapter members were shown what is being accomplished

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CHAPTER NEWS

by the State Civil Defense Department in preparation for national and local emergencies. A tour of the Civil Defense Headquarters revealed the scope of the complicated state-wide communications system and gave the AFCEA group a look at the radiological laboratories.

Chapter Secretary Robert McMorrow reports that the trend of Sacramento meetings this year is to get out and actually see some of the local allied subjects of interest to people connected with and interested in communications and electronics.

San Francisco

The NIKE was featured at the chapter's December 2nd meeting, with Colonel Steven S. Cerwin, Sixth Army Signal Officer, host to the chapter.

One hundred and seven members and guests visited the Presidio's NIKE battery which is under the command of Major H. L. Havens. Following the tour, a dinner-meeting was held in the Officers' Club.

Colonel Cerwin spoke briefly on the NIKE and remarked how this highly complex electronic missile typifies the spirit of the AFCEA since it was developed by the type of people as are represented in the chapter. Major Havens gave further details on the NIKE and presented a film giving a global aspect of anti-aircraft defense entitled "Ring of Steel."

A lively question and answer period ended a most interesting and educational evening.

Scott-St. Louis

A program on "The Bell Transistor" was presented by the Southwestern Bell Telephone Company at the November 4th meeting. Mr. Irvin Mattick, Public Relations Supervisor, conducted a lecture-demonstration on the history of the transistor and its future applications in communications and electronics for industry and the Services.

The chapter's fourth anniversary dinner was held on December 2nd. Traditionally, the Association's national president is an honor guest at this occasion, together with a prominent

New York's October guest speaker Vernon B. Bagnall, DEW Line Project Manager, Western Electric Company.

speaker. This year, the principal speaker was to be Major General Francis L. Ankenbrandt, Director, Communications-Electronics, The Joint Chiefs of Staff. Unfortunately, a thick fog prevented air travel and both President Bailey and General Ankenbrandt were unable to be present. Chapter President Harry Cooper was out of town and was flying back for the meeting but his plane was also grounded.

However, with the aid of several resourceful members, the chapter rose to the occasion and staged a program which proved of interest to the more than one hundred members and guests present. Colonel C. E. Beasley, Commandant of Technical Schools, Scott Air Force Base, and chapter director, came to the rescue with an excellent talk on "Aims of Air Force Training"; Howard Yund secured a copy of the SAGE film and the necessary projection equipment; and Allan Eisenmayer, chapter secretary, presided as master of ceremonies. One item on the originally planned program took place as per schedule—a surprise visit by Santa Claus, usually known as James J. Logue, chapter member.

Seattle

At the invitation of Captain James Connelly, Master, the chapter visited

New York Chapter's November meeting was addressed by C. C. Duncan, General Manager of Special Projects, AT&T Long Lines. Shown, l to r, are: Arthur Van Dyck, RCA; Stanley F. Patten, 1956 chapter president-elect; Mr. Duncan; Allan E. Wharton, chapter president, and Benjamin H. Oliver, chapter vice-president.

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CHAPTER NEWS

Pittsburgh Chapter members shown at Western Electric's new distribution house, l to r: S. C. Stoehr, Jr.; L. A. Shew; W. J. Love; H. W. Shepard, Jr., chapter secretary; A. M. Crawford, chapter president, and D. T. Finley.

the Army cable ship *Albert J. Myer* on October 12th. This ship is maintained at the Seattle Army Terminal by the Transportation Corps primarily for laying and maintaining submarine telephone and telegraph cables for the Alaska Communication System.

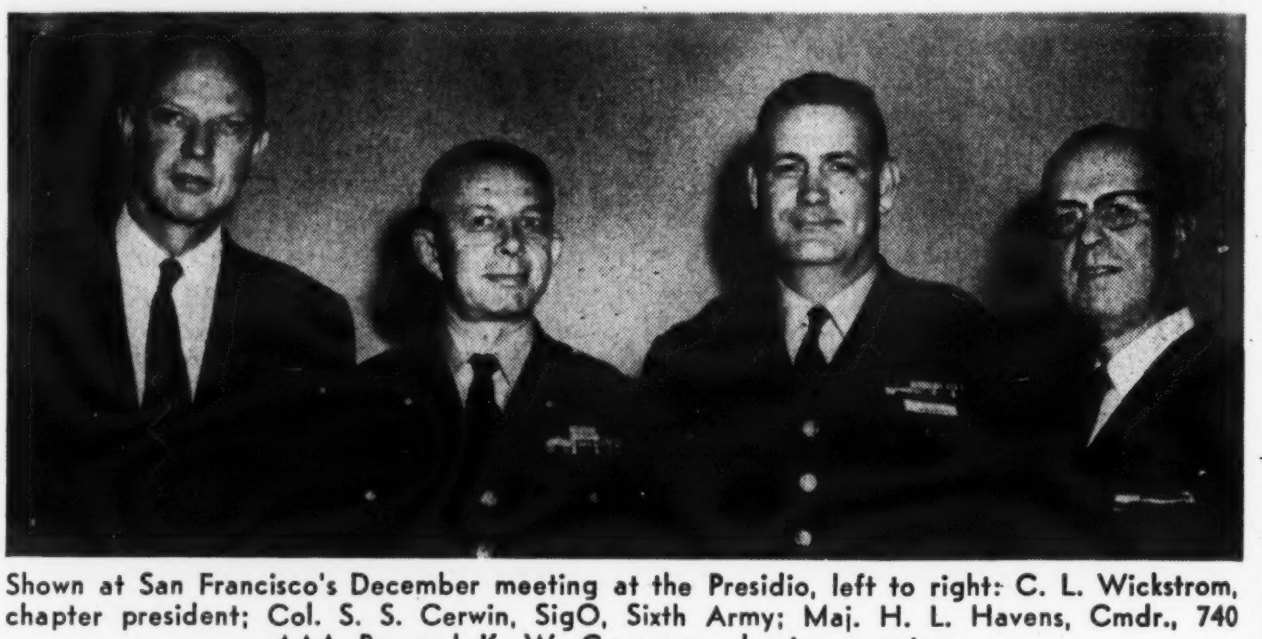
Captain Connelly conducted the group through the ship from "stem to stern," explaining all features of the ship with special emphasis on cable storage, handling and laying facilities. This is one of the most modern cable ships afloat and is fully equipped to handle any type of cable laying or repair operation.

The tour proved to be of considerable interest. On its completion, the members and guests enjoyed a social hour and coffee.

South Texas

Major General Gordon A. Blake, Director of Communications-Electronics, USAF, was the principal speaker at the November 15th dinner-meeting. Held at Randolph Field Officers' Club, one hundred and forty members and guests turned out to hear the honor guest.

With "Air Force Emphasis on Electronic Maintenance" as his topic, General Blake discussed maintenance problems, their scope and the methods employed to solve them.



Shown at San Francisco's December meeting at the Presidio, left to right: C. L. Wickstrom, chapter president; Col. S. S. Cerwin, SigO, Sixth Army; Maj. H. L. Havens, Cmdr., 740 AAA Bn, and K. W. Goossens, chapter secretary.

Special guests were Brigadier General Edgar A. Sirmyer, Jr., commanding officer, USAF Security Service; Colonel Snider, commanding officer, AACS Wing; Ralph N. Ness, vice president, Graybar Electric Co.; and National Executive Vice President George Dixon who reported on national Association affairs.

Colonel Francis B. Morgan, USAF Security Service, who succeeded to the chapter presidency when Howard Davenport was transferred to Arkansas, presided and introduced the distinguished guests.

Southern Connecticut

Major General Gordon A. Blake addressed the Southern Connecticut Chapter on October 27th on the subject of "Our Air Warning System." His speech appears on page 15 of this issue for the benefit of all AFCEA members.

Guests at the meeting included members of the Ground Observer Corps, the state Civil Defense agency, the Civil Air Patrol, and representatives of the communications and electronics industry in the area. The meeting was held in the auditorium of the Southern New England Telephone Company.

The chapter's annual business meeting took place in Bridgeport on December 1st. The program included the election of new officers and discussion of plans for 1956.

Southern Connecticut Chapter's October meeting. Left to right are: Capt. Leo Mulcahy, State Director, Connecticut Civil Defense; Mary Walsh, administrator, New Haven Filter Center; Maj. Gen. Gordon A. Blake, guest speaker; Edgar L. Love, chapter president, and Maj. Delaria, Liaison Officer, Filter Center.

Lincoln Thompson, vice president of Raymond Engineering Laboratory, Inc., was elected to succeed Colonel Edgar Love, the chapter's first president. The vice-presidents are: Charles Ecklund, Dictaphone Corporation; Edwin P. Hurley, Southern New England Telephone Company; Spencer Montgomery, Jr., The Montgomery Company, and Rodney E. Nelson, Machlett Laboratories, Inc.

The new secretary is John N. Higgins of KIP Electronics Corporation, and the treasurer is I. T. Shapiro of the Signal Corps Supply Agency.

Members of the 1956 board of directors are: T. H. Beard, Dictaphone Corporation; J. B. Cook, Whitney Blake Company; Charles Ecklund, Dictaphone Corporation; John N. Higgins, KIP Electronics Corporation; H. J. Hoffman, Machlett Laboratories, Inc.; Edwin P. Hurley, Southern New England Telephone Company; Edgar L. Love, Whitney Blake Company; J. J. McKeon, SoundScriber Corporation; Spencer Montgomery, Sr., and Spencer

Some of the members and guests present at the December 2nd luncheon-meeting of the Washington Chapter, held at the Willard Hotel.

Montgomery, Jr., The Montgomery Company; Rodney E. Nelson, Machlett Laboratories, Inc.; I. T. Shapiro, Signal Corps Supply Agency; Lincoln Thompson, Raymond Engineering Laboratory, Inc., and W. W. Wrenn, Southern New England Telephone Company.

In his "inaugural" address, Mr. Thompson emphasized the importance of greater participation of the membership in the monthly meetings and suggested that meetings be held at various locations within the state and that interested local guests be invited to open meetings on such occasions.

At the conclusion of the meeting, Edwin P. Hurley presented a film of the damage caused by the August floods which depicted the fine work done by the telephone company in the prompt restoration of service to the stricken areas.

Tinker-Oklahoma City

Guest speaker at the November 16th meeting was Col. George P. Dixon, AFCEA Executive Vice President. After reviewing the history and objectives of the Association, Colonel Dixon conducted a roundtable discussion of ways and means of stimulating interest in the chapter, such as programs keyed to the varied interests of the membership, etc.

The meeting was held at Tinker Air Force Base, with Chapter President James F. Nichols presiding.

Washington

William H. Martin, Director of Research and Development, Department of the Army, was guest speaker at the chapter's luncheon on November 3rd.

In discussing "Research and Development in the Army," Mr. Martin informed the group that, as a result of a special study made by his office, work on some research and development projects was being stopped and on a number of others curtailed. He pointed out, however, that activity on certain projects, such as some of the guided missile projects, was being increased. (See "Quotes in Review," page 38.)

The December 2nd meeting heard Robert F. Kennedy, counsel to the Senate Investigation Sub-committee, report that he and Supreme Court Justice Douglas were spied upon, given the run-around and openly lied to by Communist officials during their tour of the Soviet Union late last summer.

More than 300 attended the meeting, including representatives from the State Department, Central Intelligence Agency, Foreign Service Institute and the Department of Defense.

Mr. Kennedy said he doubted the Soviet would ever be capable of anything more than "smiles as crooked and promises as empty as they have been in the past." On that basis, he said, we cannot afford to strengthen them while we weaken ourselves.

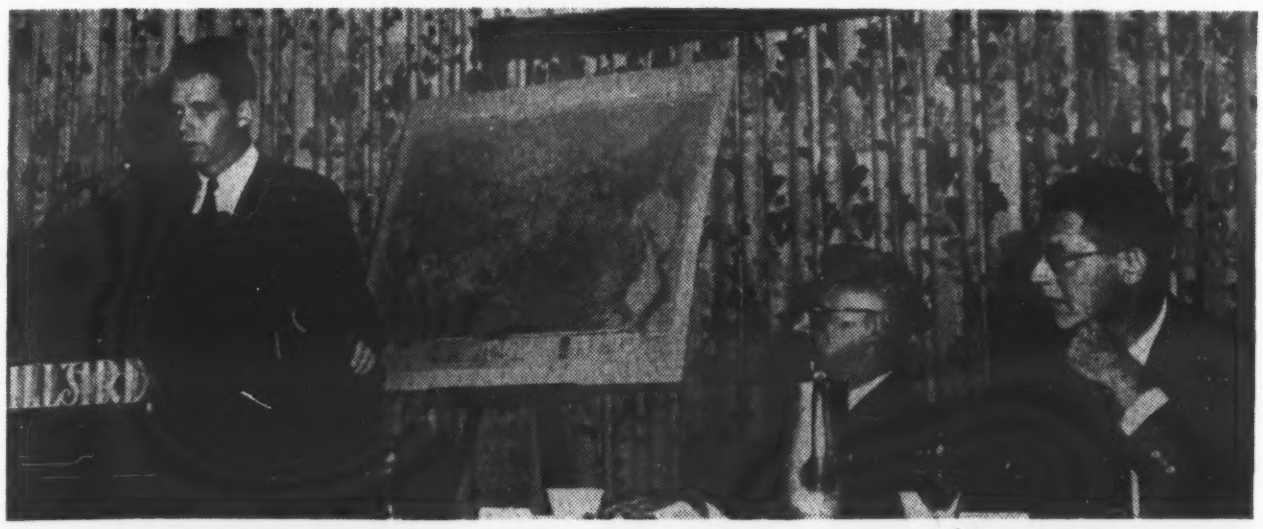
On their trip, Mr. Kennedy and Mr. Douglas devoted most of their time to the seldom-visited states of Kazakhstan, Turkmenistan, Uzbekistan, Tadzhikystan and Kirghizia. In Soviet Central Asia, seldom visited by foreigners, Mr. Kennedy said they found Communist officials "openly lied" in answering their questions concerning labor figures, farm output and industrial matters.

He further said the party was given the run-around—on orders from Moscow—in at least one important instance. It denied them a visit to Karaganda, in Kazakhstan, which he described as "probably the greatest slave labor camp in the Soviet Union." He said he found out later that the area's principal city was a "community completely made up of slaves."

Mr. Kennedy declared the fact-gathering trip also was hampered by a Soviet-furnished interpreter who withheld pertinent information and gave the party false translations.

Hitting at Communist boasts that Russia opposes colonialism and segregation, he said, "Many parts of Central Asia cannot be described as anything other than Soviet colonies where Moscow sets the wage scales, provides the only reading material and classifies all workers as employees of the state." He added that all outward appearances of religion are gone from those areas.

Robert F. Kennedy, General Counsel, Senate Permanent Subcommittee on Investigations, addressing Washington Chapter's December meeting.



Student Chapters

Iowa State College

Chapter officers for 1955-56 are as follows: president—Roger H. Johnson; vice president—Edmund F. Abodeely; secretary—Richard D. Blythe; treasurer—John K. Hopley.

Northeastern University

Division A held its annual elections on November 19th, with Stanley R. Swartz chosen as the new president. The other new officers are: vice-president—Robert Beatty; secretary—Barry Winston; treasurer—Richard Cooke. Committee chairmen were also elected as follows: program—Ugo Fonte, and publicity—Otto Pearson.

The chapter voted to affiliate with the Boston Chapter, at the same time retaining their identity as the Northeastern University Student Chapter. An electronics workshop has been set up and several experimental projects are now in progress. Whenever possible, the student chapter participates in the various school activities. As a result of this and its own program of activities, the chapter is gaining wider recognition throughout the university and membership is growing steadily.

• *One of a series of institutional messages.*

The President of CREI asks . . .

Can a Technical Institute train the kind of men You need?

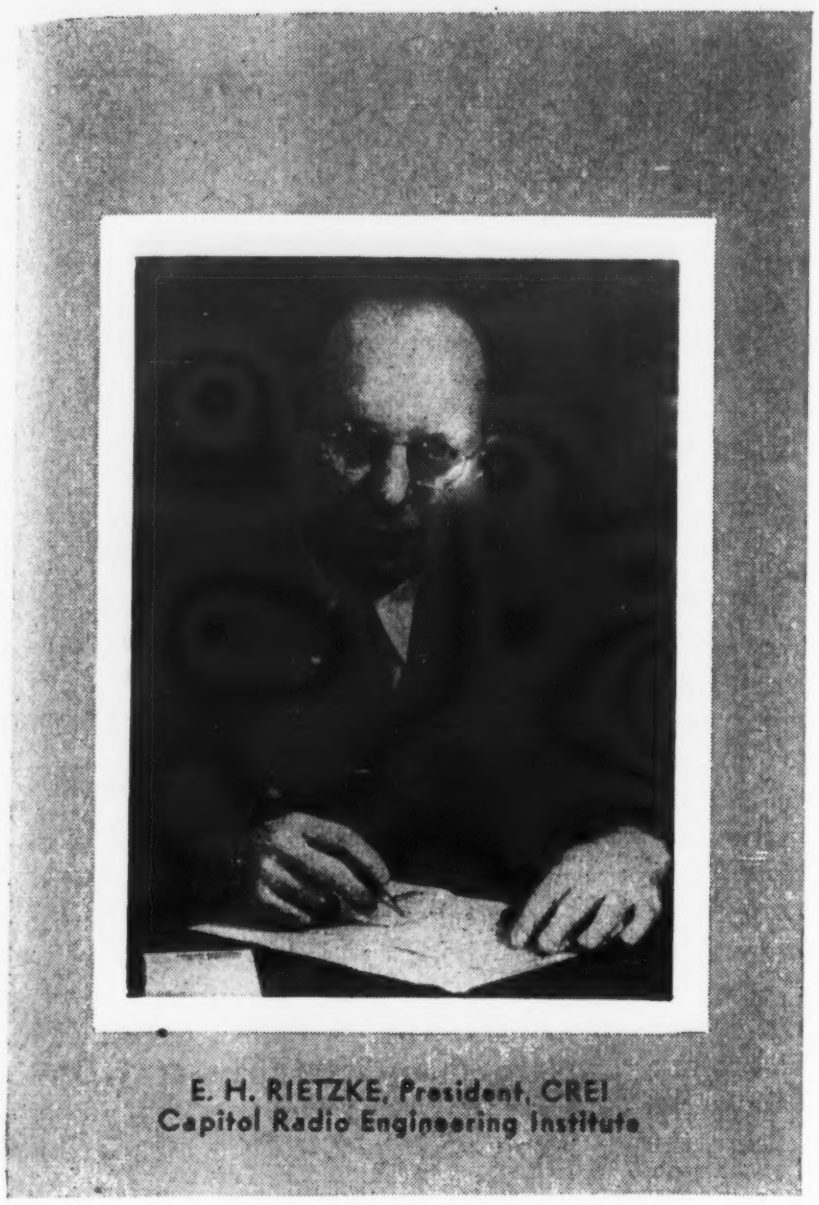
THERE are a number of good Technical Institutes. CREI, as one of America's leading Technical Institutes offering ACCREDITED CURRICULA, invites you to answer the above question after reading our ideas on the subject, as expressed below.

1. WHO ACCREDITS THE CURRICULA OF TOP TECHNICAL INSTITUTES? Capitol Radio Engineering Institute curricula have been accredited for a number of years by Engineers' Council for Professional Development, the nationally recognized organization for the accreditation of the curricula of engineering colleges and technical institutes. CREI is a founder member of the National Council of Technical schools which first established strict educational and ethical standards for this important area of technical education. CREI is listed in the U. S. Office of Education Directory, "Higher Education". CREI is authorized by the District of Columbia Board of Education to grant the Degree of Associate in Applied Science.

2. WHAT KIND OF PERSONNEL DO WE TRAIN? Our Institute trains sound, *practical* engineering personnel who "can get a job done". This is especially important in view of the growing trend in engineering colleges toward less and less specialization. Their major emphasis is on turning out broadly educated men qualified for basic research assignments. Both are essential.

3. ARE TECHNICAL INSTITUTE GRADUATES "TECHNICIANS" OR "PRACTICAL ENGINEERS?" CREI does not claim to turn out "Engineers" in the accepted professional meaning of the term. However, the term "Technician", as very often used in the field and as customarily applied to graduates of technical institutes, in our opinion is not an adequate designation for our graduates. In fact, graduates of CREI start in practical engineering capacities and at average salaries generally equivalent to those of engineering college graduates.

4. WHERE ARE TECHNICAL INSTITUTE GRADUATES QUALIFIED TO START? CREI graduates are qualified to start, and do start in



E. H. RIETZKE, President, CREI
Capitol Radio Engineering Institute

industry, in a supporting engineering capacity, in production, design or testing, alongside of graduates of engineering colleges. While the latter may ultimately be of maximum value in research assignments, the technical institute graduate will generally find his most useful role as project engineer, design engineer or field engineer.

5. WHAT IS THE CURRICULUM LEVEL OF OUR TECHNICAL INSTITUTE? It is of college level, and is highly practical in the applications of mathematics and theory with relation to the practical problems encountered in industry.

6. HOW LONG IS THE COURSE OF INSTRUCTION? At CREI three collegiate years are condensed into an average of 26 months. Students attend classes 35 hours per week, 48 weeks per year. All of this time is devoted to practical engineering subjects. Strictly liberal arts subjects are minimized.

7. WHAT ARE THE QUALIFICATIONS FOR ENTRANCE? Students must be graduates of high school, or the real equivalent (to be determined by proper examination) with adequate preparation in mathematics and science. As a matter of fact, at the CREI residence school, students are accepted only through strict aptitude tests. More than half the applicants are rejected by these tests.

8. WHAT DOES OUR TECHNICAL INSTITUTE OFFER TO STUDENTS? We offer an educational program which will equip them in a minimum of time, for happy professional lives in rapidly growing industry, where advancement will be limited only by their own ambition and willingness to work.

9. WHAT DOES OUR TECHNICAL INSTITUTE OFFER TO EMPLOYERS? To employers interested in hiring men who have a sound background in practical engineering and who "can get the job done", we invite you to join the long list of the nation's leading firms who regularly look to us for new technical talent.

You can do a service to your industry, your company, and technically inclined young men, by understanding this type of educational program and recommending it to interested, qualified personnel. We will gladly furnish complete information upon your request.

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ITEMS OF INTEREST

From Government, Industry and the Services

$800 Million Assigned For Defense Department Electronics

In assigning its funds for the fiscal year of 1956 which began July 1, the Department of Defense has recently announced that it has made available $825,135,000 for the procurement of electronics and communications equipment. This amount includes new funds plus the unobligated balance from the program for the fiscal year 1955.

Under the communications and electronics budget category come funds for equipment procured individually or as government-furnished equipment for use in items such as aircraft and guided missiles. Excluded from this category is contractor-furnished electronic equipment installed in other weapons.

For all major procurement and production, the fiscal year 1956 program is over $20.3 billion. Of this, $12.6 billion is for aircraft, $1.6 billion is for guided missiles and just under $1.6 billion has been allotted for research and development.

BDSA Urges Wider Use of Patented Inventions Index

The nation's manufacturers and businessmen are urged by the Business and Defense Services Administration, U.S. Department of Commerce, to make wider use of the Government's *Index of Patented Inventions* to stimulate further the national economy.

This index, containing brief descriptions of over 21,000 inventions, has been placed in the Public Search Room of the U.S. Patent Office in the Commerce Building in Washington, D. C., and is thus made readily accessible to all who wish to examine it. It should be of particular interest to manufacturers seeking to improve their products, develop new ones or start in manufacturing.

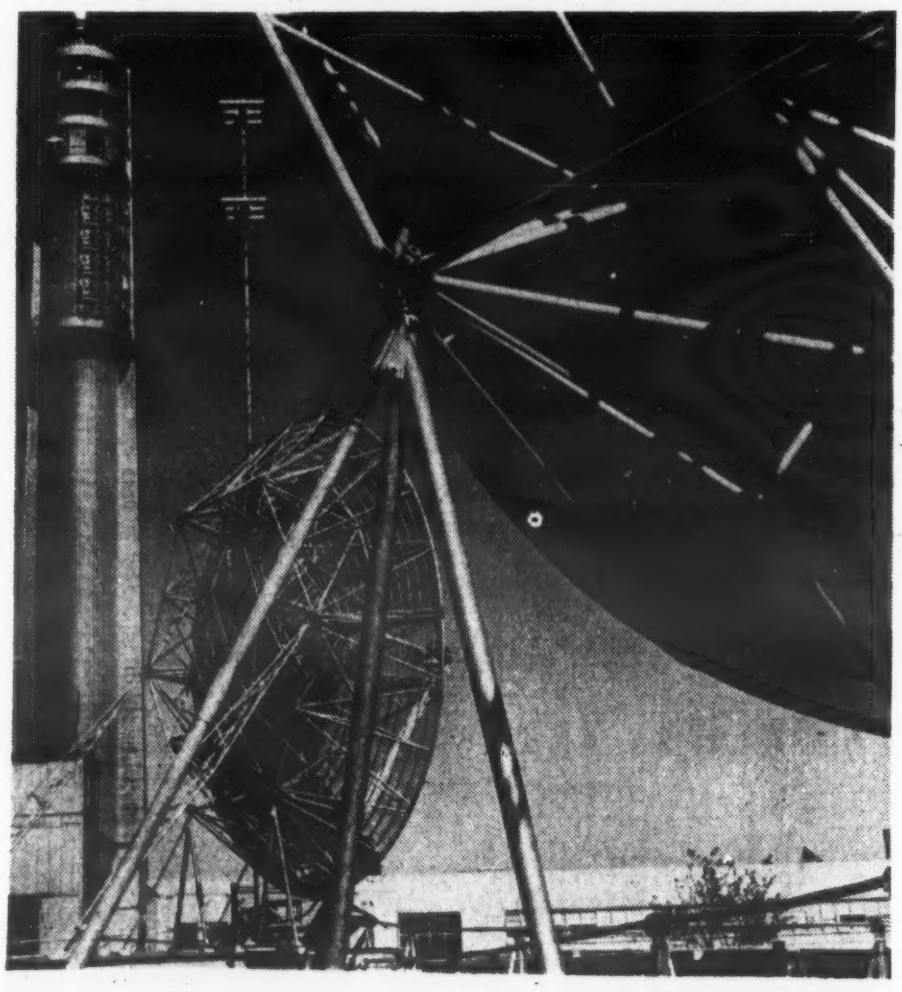
The index contains informative descriptions of approximately 5,000 Government-owned patents which usually can be made available without payment of royalties. The file also covers 16,000 additional inventions which have been licensed to one of the Federal agencies and can be obtained on a license basis from the inventor or present owner of the patent.

Navy Will Test TV to Monitor Airport Landings

The U.S. Navy has announced that it plans to install a closed circuit television system to control airport landings and takeoffs. This system is scheduled to undergo trial evaluation at the Alameda Naval Air Station near Oakland, California.

Three waterproof television cameras placed along the runway and connected to viewing screens in the control tower will enable tower operators to view planes along the runway, even including aircraft identification markings.

This proposed closed-circuit television system will cost approximately $50,000, about one-tenth of the estimated cost of moving the control tower or increasing its height.



Microwave — Experiments by International Telephone and Telegraph Corp. scientists are yielding important new findings in the application of over-the-horizon techniques to multichannel radio communication. Chief advantage is that it can be designed to cover distances from line-of-sight to 300 miles or more without intermediate amplification. New technique is ideal for TV and in bridging vast land and water areas. Shown here atop building of Federal Telecommunication Laboratories in Nutley, N. J. are parabolic antennas used for communication with Southampton, Long Island, 91 miles away.

Technique is being tested in commercial links in the Caribbean and Mediterranean areas.

ARMY AND AIR FORCE ANNOUNCE 1956 VACUUM TUBE PROCUREMENT

The Army Signal Corps will procure approximately four million electronic vacuum tubes during the fiscal year 1956.

This estimate, which is subject to modification, is expected to include more than 280 different types of tubes. Tubes to be used by both the Army and the Air Force are included in these figures since the Army buys this item for the Air Force.

Prospective suppliers may obtain additional information concerning electron tube procurement from the Commanding General, Signal Corps Supply Agency, 225 South 18th Street, Philadelphia 3, Pennsylvania.

Secretariat for Test Equipment Group Established by DoD

Acting upon recommendations from the three Services, the Defense Department has approved the establishment of a permanent Secretariat for the Electronic Test Equipment Coordinating Group. With this action, the group is now placed on a par with the Advisory Groups on Electron Tubes and Electronic Parts.

The Electronic Test Equipment Coordinating Group was established by the Defense Department on September 1, 1955. Its purpose is to serve as a clearing house for information on electronic test equipment and to achieve a coordinated and integrated program in the field.

The Secretariat will provide technical and administrative assistance in addition to gathering technical information from the industry.

Renominated as members of the Electronics Test Equipment Group were: Robert Fox, Office of the Chief Signal Officer; Earl Weimer, Naval Research Laboratory; Major George W. Moyer, USAF, Headquarters, Air Research and Development Com-

mand; Colonel Abramovich, acting chairman and secretary, Office of the Assistant Secretary of Defense for Research and Development; R. H. DeWitt, Office of the Assistant Secretary of Defense for Applications Engineering, and M. A. Ford, Office of the Assistant Secretary of Defense for Supply and Logistics.

Secretary Brucker Praises Command Management School

Stating that any waste in money, material or manpower is reflected in the Army's combat power and that combat power is the "root and branch" of the Army's abilities to carry out its responsibilities for national security, Secretary of the Army, Wilber M. Brucker, praised the Command Management School for its efforts in the field of command management.

The Command Management School is a Department of the Army activity established in November, 1954 to bring selected senior military officers and civilian officials abreast of modern techniques and trends in non-tactical command management. Management problems in the Army have become increasingly intricate and complex with the growth of the military in recent years, and it was felt that there was a definite need for a school such as the Command Management School, located at Fort Belvoir, Virginia.

Speaking to the 1955-56 class, Secretary Brucker stated that the military establishment has become a business operation and like every large enterprise demands top-scale efficiency and good management.

Instructors' Conference Held at Fort Monmouth

An Instructors' Conference, designed to establish a closer liaison between Signal Corps instructors at Service Schools throughout the Army and their home organization, Fort Monmouth, has been inaugurated at the Signal School.

Commandant of the Signal School, Brigadier General William D. Hamlin, stated that it is hoped that the Signal instructor can be kept up to date with the swiftly changing developments in the Signal Corps through the Conference's symposiums, panel discussions and presentations.

Major General Victor A. Conrad, Commanding General of the Signal Corps Center and Fort Monmouth, officially opened the Conference by welcoming the instructors back to "home base."

There were presentations by the Office of the Chief Signal Officer and its Plans and Operations Division, the Signal Corps Board, the Signal School, the Signal Corps Publications Agency, the Army Pictorial Service and the Signal Corps Engineering Laboratories.

As a climax of the conference, Major General James D. O'Connell, USA, Chief Signal Officer, addressed the conferees on "The Role of the Signal Corps in the Army of Today and the Future."

Judging by the success of this conference, it seems likely that it will be an annual affair.

AUTOMATIC ELECTRIC TO BUILD 16 MILLION DOLLAR FACTORY

A new multi-million dollar factory, research laboratory and general office structure will be erected by Automatic Electric Company in Northlake, Illinois, near Chicago. The new facility is expected to cost in excess of 16 million dollars and be completed by late 1957, according to L. H. Warner, president of Automatic Electric.

The overall structure will contain approximately 29 acres of floor space. It is designed for the utmost efficiency in manufacturing with adequate provision for any necessary future expansion.

When this new plant is completed, the company will be able to consolidate into one facility all its Chicago operations which are now housed in fourteen different buildings on the near west side of Chicago.

NBS-BuAer Preferred Circuits Standardization Program

A standardization program, undertaken for the Navy Bureau of Aeronautics by the National Bureau of Standards, is attempting to standardize many of the electronic circuits used in Navy aeronautical equipment.

This program is seeking to determine those well-known circuit configurations that are common to a wide variety of electronic devices but which now differ unnecessarily in detail.

Known as the NBS-BuAer Preferred Circuits Program, this continuing investigation may result in important economies in critical engineering man-hours, in lead time, and by accelerating production. It should also provide the Services with a

(*Continued on page 74*)

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means for simplifying maintenance training, designing simple "throw-away" units, achieving improved operational reliability and establishing design standard levels. These objectives can be achieved without requiring rigid compliance to the preferred circuits; these circuits are intended as a design guide only.

The Study is being carried out by J. H. Muncy and associates of the NBS Engineering Electronics Laboratories. The Bureau is cooperating with industrial groups engaged in similar programs through exchange of information.

Air view of the new Wayland Engineering Laboratory of Raytheon Manufacturing Company. This recently completed structure contains more than five acres of laboratories, drafting rooms, offices and machine shops. It occupies part of a 73-acre site, and is the largest single industrial electronics laboratory in New England.

Army Multilanguage Machine Writes in 50 Languages

In answer to the need for a means of communicating with the various populations in the major political and geographic areas of the world, the Department of the Army has announced the development of the "50-Language Vari-Typer."

Soon, any soldier will be able to write in over 50 different languages on one typewriter-like device even though he has no knowledge of the language he is writing.

After extensive study by the Army Quartermaster Corps and the Office of the Chief of Psychological Warfare, two products of the Ralph C. Coxhead Corporation, Newark, New Jersey, were found to be the most readily adaptable to the needs of the Army. These machines were the Coxhead Vari-type and its mate, the Coxhead-Liner.

Interchangeable type fonts simplified the problem with Latin languages, but the problem was more involved with Hebrew, Arabic or Sanskrit. After exhaustive research, the Army now has a Coxhead Varityper which writes in over 50 languages, including a reverse carriage model which types from right to left, needed for Hebrew, Arabic, Persian, Urdu, Malayan, Jowi and Pushtu.

The device is simple to operate. The message is written by a linguist in the language desired; then appropriate numbers are substituted for characters, with diagonals, circles, and squares to indicate punctuation. With the proper font in the machine, the operator strikes the keys according to the numerical sequence of the message.

When this is completed, the typing resembles commercial printing. This is photographed, an offset plate is made and the printing begins.

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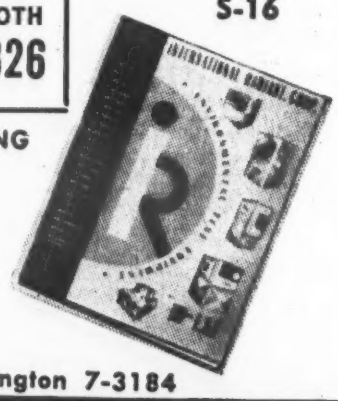
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Industry Representatives Attend Army Procurement Conference

More than 200 representatives of various industries attended an industrial procurement conference at the Pentagon in November to discuss with Frank H. Higgins, Assistant Secretary of the Army for Logistics, the subject of Army procurement.

Objective of the meeting was to maintain the contractual relationships between Government and industry through an informal discussion of problems in the procurement field.

A similar series of meetings were held recently in various parts of the country for contracting officers, purchasing agents and buyers for the Army with those officials at Department of Army level responsible for formulating procurement policies. As a result of the success of these conferences, a number of industrial leaders requested that a similar meeting be arranged for them.

The agenda for the meeting provided discussion on the subject of directives; all types of contracts; use by contractors of Government-owned facilities; pre-award matters; Department of Army relations with contracting officers; the Army's small business program; maintenance of the mobilization base; price redetermination and profit and other matters relating to procurement.

JOINT COMPUTER CONFERENCE

The 1956 Western Joint Computer Conference, sponsored by the American Institute of Electrical Engineers, the Association for Computing Machinery, and the Institute of Radio Engineers, will be held in San Francisco Februorv 7-9.

A number of papers will be presented, as well as exhibits by manv of the prominent companies in the computer field.

Signal Officers Complete Amphibious Training Course

More than 100 student officers at The Signal School, Fort Monmouth, recently completed a four-day specialized amphibious training course at Little Creek, Virginia, through the cooperation of the Air Force, Navy and Marines.

The officers, students in the Advanced and Associate Advanced

courses at The Signal School, learned the techniques of providing communications for an assault landing on enemy shores at Little Creek's famous Amphibious Training Center at Norfolk, Virginia.

After the Air Force had flown the officers to the Naval Air Station at Norfolk, the Navy and Marine Corps took over and began preparing the officers for the communications requirements necessary for the successful accomplishment of an amphibious operation.

As a concluding phase of their classroom work—which included instruction in ship-to-shore movement, joint amphibious task force communications gunfire support in the amphibious operation and air support in the amphibious operation—the students were briefed on a landing involving two regimental combat teams. The officers were required to act as communicators from the division signal officer down to wireman and radio operator.

The actual amphibious assault landing concluded the training for the group. Carrying AN/PRC-10, AN/GRC-9 and AN/MRC-6 radio sets along with SB-22 switchboards, the officers stormed the beach and established communications minutes after landing. Major nets were set up and the division command net went into operation immediately. Wire communications were installed as rapidly as various echelons arrived on the beach.

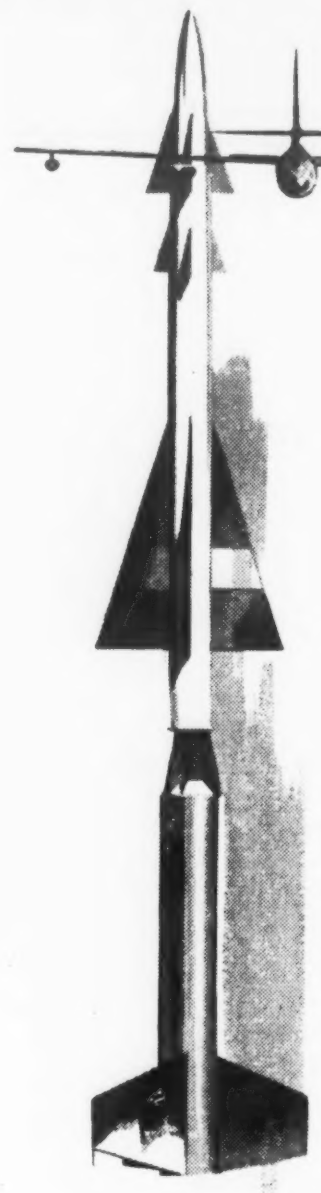
The student officers came through the exercise wiser in the operations of the Air Force, Navy and Marines and staunch advocates of inter-Service cooperation.

RCA Transistorized Interphone for Airplane Communication

A transistorized interphone system which can be worn by ground crewmen to provide communication with personnel inside aircraft being serviced has been developed by the Radio Corporation of America.

This new device offers important savings in space and weight over conventional means for providing inside-outside communication on military planes, since it enables ground personnel to carry equipment normally installed in the aircraft. It is designed for use with the RCA AN/AIC-10 airborne intercommunication system which is widely used by the U.S. Air Force.

(*Continued on page 76*)



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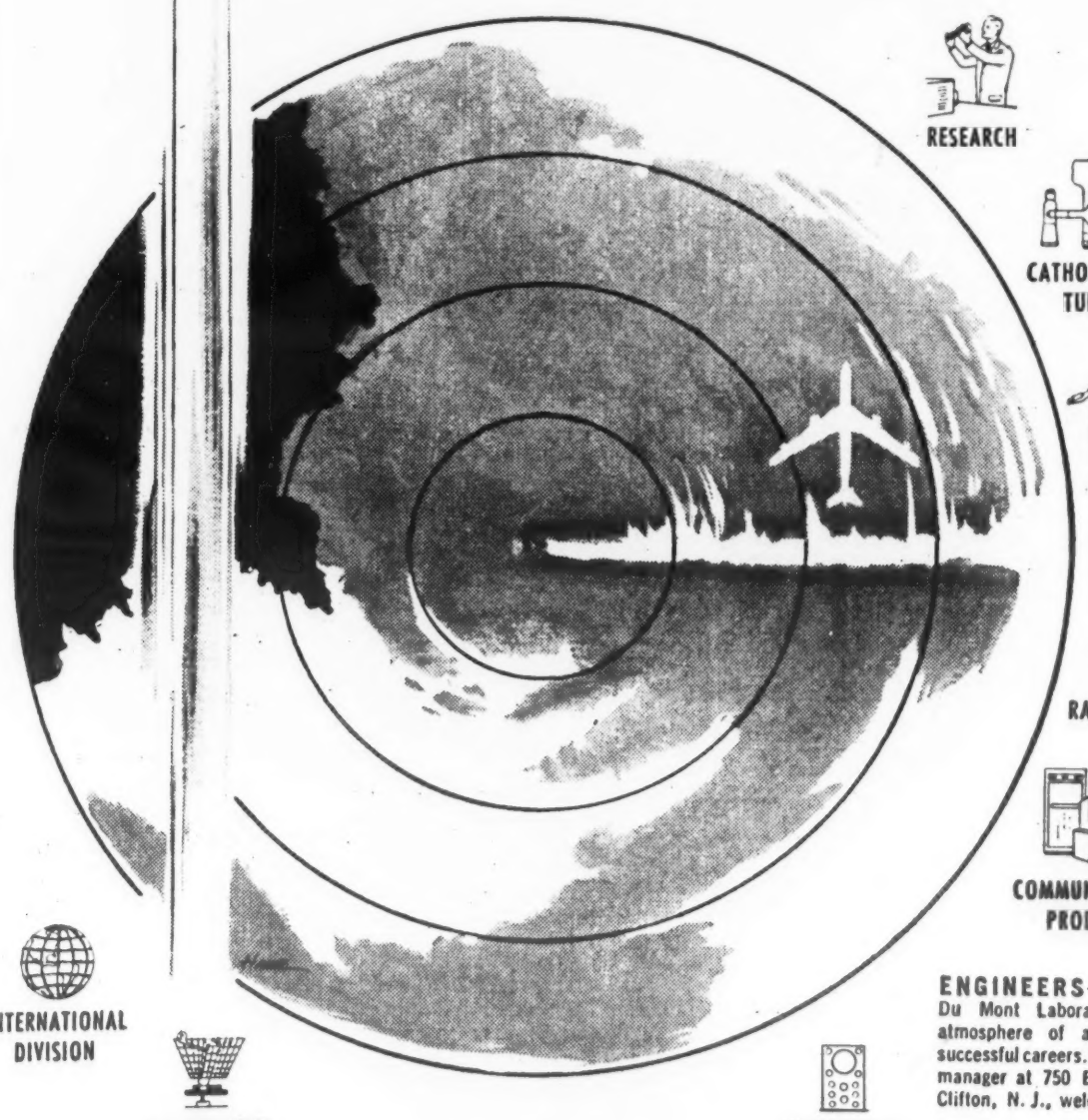
And do you know about the new "seeing shields" which direct these "seeing arrows"? The latest supersensitive radar can picture the size, number, changing speeds, heights and directions of a possible aerial invader from 200 miles and more away! *And it screens our hemisphere today!*

There is Du Mont research behind *all* U. S. radar. *And Du Mont cathode-ray tubes for radar have been called "the best," in a postwar report by one of the leading government laboratories of national defense.*

Continuing Du Mont research and development in *all* phases of televisual electronics results in products of the *finest precision* and *reliability*. These products ...used in national defense, science, industry and in the home...now benefit our lives in countless ways!



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ITEMS OF INTEREST

The 15-ounce interphone is worn suspended from the neck. Communication inside the plane is established by merely plugging the phone's connecting cable into a fuselage receptacle which, in turn, is wired into the plane's intercom system.

The successful application of transistors made possible this lightweight interphone station sufficiently small to be carried by ground personnel. The device is built around four transistors in a simple amplifier circuit. It requires only 27½ volts, which it takes from the plane through the receptacle, and measures only 4 inches long, 2½ inches wide, and 1½ inches deep.

AEPG Procurement Office Moves to Tucson

The Procurement Office for the Army Electronic Proving Ground located at Fort Huachuca, Arizona, has now been moved from the Fort to Tucson, Arizona.

The new address is: Signal Corps Supply Agency, P. O. Box 5117, Tucson, Arizona. Colonel J. F. Reilly continues as the Contracting Officer.

The RP-71 drone, recently developed at the Battlefield Surveillance Department of the Army Electronic Proving Ground, Fort Huachuca, Arizona. (See article below.)

Photography

AERIAL PHOTO DRONE DEVELOPED BY SIGNAL CORPS

A small camera-carrying drone, controlled by radio, has been added to the weapons of combat aerial photography by the U.S. Army Signal Corps.

Developed at the Army Electronic Proving Ground, Fort Huachuca, Arizona, this drone has a wing span of only 12 feet, a speed of 228 miles per hour, and can climb at the rate of 3,060 feet per minute. It is propeller driven by a gasoline motor while in the air. Overall length of the drone is 12 feet.

It can take either still photographs or motion pictures from a low altitude range of several hundred feet up to heights of more than four miles in the air. By using the drone, tactical commanders can be supplied with aerial surveillance photographs in less than an hour's time.

The drone can operate in any area because its take-off is jet-assisted, thus eliminating the need for an airfield. Another advantage is that the drone will operate in all kinds of weather without risk to personnel and can perform its mission regardless of whether the U.S. Army has air superiority. Also, the drone will provide aerial surveillance at less cost than many other means now used.

Operation of the drone is simple. The catapult is assembled and the drone prepared for flight in about five minutes. A control operator on the ground guides the drone in flight by means of a stick box, similar to a "joy" stick, which enables the controller to bank and maneuver the drone.

Upon completion of its mission the control operator returns the craft to the launching area. When the drone is over the launching area, a parachute is released and the engine is automatically stopped. The parachute used to bring the drone to the ground is a 38-foot cargo chute. The plane descends at a rate of approximately 20 feet per second. When the craft has landed the films are picked up for immediate processing.

X-RAY MOTION PICTURES TO BE COMMERCIALLY AVAILABLE

According to an announcement by the University of Rochester, x-ray motion pictures — known technically as Cinefluorography — have made their commercial debut. The General Electric Company, X-Ray Department, Milwaukee, Wisconsin, will soon manufacture such units commercially.

Dr. James S. Watson, radiologist and Sydney A. Weinberg, associate in radiology, of the University of Rochester Medical Center, have developed and designed the equipment.

The new apparatus has been designed for use with conventional x-ray equipment, and can be used for taking pictures with the patient seated, standing, or as is desirable in many instances, lying down. The picture taking area is 15" x 15", almost as large as the conventional 14" x 17" x-ray film. The device can be used with either 16mm or 35mm film and offers a speed range of 3¾ to 30 frames per second.

Heart of the device is the f/0.71 lens, which is about 30 times faster than the lens on a newspaper photographer's camera. Also vital is the electronic triggering mechanism which turns the 100,000 to 130,000 volt x-ray on and off up to 30 times a second, in perfect synchronism with the motion picture camera, minimizing the x-ray dosage that the patient receives.

Dr. Watson of the research team points out that "the unavailability of commercial equipment has been a deterrent to many radiologists and scientists who have been interested in the clinical and research applications possible with x-ray motion studies. Its usefulness has been extended to biological studies and the field of animal husbandry. Use of this method will spread to many centers now that equipment is available."

Automatic Remote Control Camera System Developed

Development of an automatic, electronic remote control system to operate aerial cameras in high-speed photo reconnaissance airplanes was disclosed recently by the Air Research and Development Command.

The equipment, known as the Universal Camera Control System, automatically controls camera settings and operation in flight, constantly adjusting for light, altitude and ground speed variations. The system can operate in flight without human attention.

Known as the UCCS, it is flexible in that it can easily be adapted to control one or as many as eleven cameras, depending upon the photo coverage desired, and eliminates the need for many individual controls on each camera. The new system is being used for both high-level and low-level photography missions by Air Force reconnaissance aircraft.

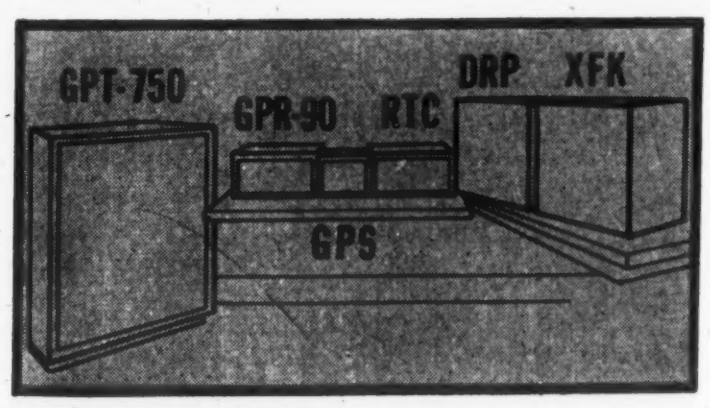
(*Continued on page* 78)

A COMPLETE hf COMMUNICATIONS STATION

You in the services are already familiar with the excellence of the various component equipments manufactured by TMC and its Canadian subsidiary, TMC (Canada) Limited.

Now for the first time, we are highly gratified to be able to offer you a completely integrated, logistically supportable, HF Communication System, with all equipments designed and manufactured under one roof, out of a single family of components, meeting and exceeding JAN/MIL requirements throughout. Many of the equipments shown above are already nomenclatured, stock numbered, and provisioned in your supply depots.

All of our equipment is designed for mobile, air transportable, and transit case packaging as well as fixed station use.



Send for Bulletins

Complete specifications, features and applications are available in separate Bulletins. When requesting Bulletins include all your needs and appropriate Bulletins will be included or you may have the complete catalog of present Bulletins and new Bulletins will be added automatically as issued.

GPT-750 The GPT-750 is a ruggedly designed transmitter for radio telephone, telegraph, frequency shift and facsimile operation over the entire range of 2 to 32 mc. It is conservatively rated at 900 watts output CW or FS and 500 watts output radio telephone, continuous commerical service, with kilowatt output commonly used in intermittent services. The GPT-750 is constructed on a building block basis providing many combinations for all the commonly used services. Its versatility is greatly extended by several accessories and details of these and the transmitter are available in BULLETIN 174.

GPR-90 The GPR-90 is a 15 tube, double conversion, super heterodyne, communication receiver, covering the frequency range of .45 to 31 mc in six accurately calibrated bands with full electrical bandspread. This Receiver is being used in all branches of communications from short wave listening to diversity receiver units (GPR-90D). Featuring the same precision construction of all TMC units, this Receiver is the finest in its class. Details of GPR-90D are available in BULLETIN 190. Details of the GPR-90 are found in BULLETIN 179.

RTC The RTC is a Remote Control Amplifier, designed to provide remote operation to the GPT-750 or similar transmitters for high impedance microphone. It provides peak clipping push-to-talk, CW and MCW operation. Designed in matching cabinet to the GPR-90 full details are found in BULLETIN 183.

DRP The DRP Diversity Receiving Package provides compact, easy to operate equipment for AM, FS, CW and MCW signals over the 2 to 32 Mc range. The basic receiver is TMC's Model FFR (AN/FRR 49 (V) and AN/FRR 502) and frequency shift is accomplished with TMC's Model CFA Converter using the PSP-1 power supply. Plug-in tuning drawers provide quick frequency changes with VFO or crystal operation. Complete details BULLETIN 170.

XFK The XFK is a highly stable exciter which replaces the crystal oscillator in the transmitter to provide "mark & space" carrier-shift transmission of teleprinter, telegraph, FM telephone, facsimile or telephoto intelligence. Carrier-shift up to 1000 cps available either linear, with applied voltage or independent of applied voltage. Range 1.0 to 6.9 mc in two bands. Full details - BULLETIN 118.

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y.

In Canada: TMC Canada Ltd., Ottawa, Ontario

ITEMS OF INTEREST

Personnel of the Aerial Reconnaissance Laboratory at the Wright Air Development Center laid out the performance requirements and general electronic design. A number of electronic and photographic equipment manufacturers then developed and constructed the system. Included were the Bill Jack Scientific Instrument Company, which did much of the development work, Allen B. DuMont Laboratories, Inc., Chicago Aerial Industries, and the Fairchild Camera and Instrument Corp.

When the airplane is in flight and the photo run is about to begin, the pilot or navigator-photographer manually feeds ground speed and altitude information to the UCCS. After that, all operation is automatic, and the system, based on a series of analog computers, constantly determines and adjusts the cameras to accommodate any variations in lighting, ground speed, or altitude.

The UCCS is constructed on a unit or "building block" plan so that its many electronic assemblies are interchangeable. This not only simplifies maintenance and supply but also enables the operator to locate quickly any faulty units by plugging the suspected unit into another circuit to check its operation.

Personnel

ADMIRAL FURTH RETIRES; ADMIRAL BENNETT SUCCEEDS

One of the Navy's top electronics specialists retired from the Navy on December 31 when Rear Admiral Frederick R. Furth, USN, left the Service after more than 30 years in a naval career.

Admiral Furth, who retired at his own request, was succeeded by Rear Admiral Rawson Bennett, former Assistant Chief for Electronics in the Bureau of Ships, on January 3, the date of his new rank.

In announcing the retirement, Navy Secretary Charles S. Thomas praised Admiral Furth for his vigorous prosecution of the Navy's research and development program. His contributions to upper atmosphere research have permitted the Navy to move rapidly ahead with the technical portion of the earth satellite program. The secretary also cited the Admiral for his contribution to new scientific advances which may mean improvements in submarine detection and for his contributions to certain advanced problems of continental air defense.

Admiral Furth, who is a member of the Board of Directors of the AFCEA, will continue in this capacity. He is now connected with the IT&T subsidiary, Farnsworth Electronics Company, Fort Wayne, Indiana, where he is Assistant to the President, Dr. Harvard L. Hull.

Admiral Bennett is also an electronics specialist with extensive research and development experience. Since the war he has served as Director of the U.S. Navy Electronics Laboratory in San Diego, California; as the first director of the tri-Service Electronics Production Resources Agency, and in other administrative-engineering posts.

Succeeding Admiral Bennett is Captain W. I. Bull, USN, who had been serving as Director of the Electronics Design and Development Division.

Recently retired Chief of Naval Research, Rear Admiral Frederick R. Furth, USN.

IRC Elects Ehle Executive Vice President

The Board of Directors of International Resistance Company, Philadelphia, have announced the election of Harry A. Ehle to executive vice president.

Mr. Ehle, formerly vice president of sales and advertising and assistant to the president, joined IRC in 1931. Active in the electronics industry, Mr. Ehle is a member of the Board of Directors of the Armed Forces Communications and Electronics Association and the Radio-Electronics-Television Manufacturers Association.

Dr. Furnas Heads R & D for Defense Department

Dr. Clifford C. Furnas, former Chancellor of the University of Buffalo, has been sworn in as Assistant Secretary of Defense for Research and Development, succeeding Donald A. Quarles who left the position to become Secretary of the Air Force.

Prior to his appointment as Chancellor of the University of Buffalo, he was Director of the Cornell Aeronautical Laboratory in Buffalo. He has been serving as a consultant to the Defense Department's Research and Development organization since 1948.

Since February 1954, Dr. Furnas has been Chairman of the Technical Advisory Panel for Aeronautics. He also has been serving as a member of the committee on Aircraft Construction of the National Advisory Committee for Aeronautics.

Barrow and Wheeler Named to New Posts at Sperry

Dr. W. L. Barrow and Dr. L. L. Wheeler, both members of the AFCEA, have been named recently to new posts at Sperry Gyroscope Company, division of the Sperry Rand Corp.

Dr. Barrow, vice president and chief engineer since 1952, has been appointed vice president for research and development.

Formerly assistant chief engineer, Dr. L. L. Wheeler has been named chief engineer. Under his direction was developed the present-day K-bombing navigational system employed by the strategic bombers of the Air Force.

GENERAL BACK JOINS IRC

International Resistance Co., Philadelphia, has announced the recent appointment of Maj. Gen. George I. Back, USA, Ret., to Assistant to the President.

General Back, recently retired Chief Signal Officer of the Army, will investigate new markets for products and processes developed in IRC's Research Department.

PERSONNEL CLEARING HOUSE

AFCEA Members Available to Industry

The pages of SIGNAL are open to active AFCEA members who are seeking positions in the communications, electronics and photographic industries. Any member is entitled to space free of charge in this column for three issues of the magazine. Please limit your notice to five lines. In replying, employers are asked to address: Box ——, SIGNAL, 1624 Eye Street, N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

MANUFACTURERS' TECHNICAL OR SALES REPRESENTATIVE. Twelve years experience in mechanical, ordnance and photographic engineering and associated fields. Full knowledge of Government specifications, standards, contract negotiations and procurement regulations. Free to travel or relocate. Box 115.

EXECUTIVE ASSISTANT, CONTROLLER OR PROCUREMENT DIRECTOR. Experienced negotiator and financial administrator, top management caliber. Degrees in business and in law, admitted to New York Bar. Twelve years experience with airborne electronics procurement and with business affairs of a microwave test equipment manufacturer. Box 116.

RESEARCH AND DEVELOPMENT CONTRACT ADMINISTRATION, Project Expediting. Field engineer, sales promotion, customer relations, many years electronics, communications, marine fields. Facilities surveys, production coordination. Automation, modular, unitization practices. Washington-Baltimore area. Box 117.

Government and Military Positions Available

Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.

COMMUNICATIONS CODING CLERK (GS-4—$3,415/year). Applications are now being accepted by the U. S. Civil Service Commission for clerks with specialized experience in communications coding work. Applicants must have had at least one year of general clerical experience and one year of specialized experience, and are required to pass a written test. Apply to the U. S. Civil Service Commission, Washington 25, D. C.

ELECTRONIC SPECIALISTS are urgently needed at the Corps of Engineers Research and Development Laboratories, Ft. Belvoir, Va. Applicants must hold a degree in electrical engineering, physics or mathematics, or have considerable research experience in their fields. Salaries range from $4345 to $8940 per year, commensurate with education and experience. Apply to Walter H. Spinks, ERDL, Ft. Belvoir, Va.

THE SPECIAL DEVICES CENTER, Office of Naval Research, located 25 miles from New York City at Port Washington, Long Island, needs electronic and aeronautical engineers. Applicants must possess degrees in engineering, and pertinent electronic or aeronautical engineering experience. Apply to Mr. David A. Lana, Industrial Relations Dept., Special Devices Center, Office of Naval Research, Port Washington, N. Y.

RADIO OPERATOR TECHNICIANS. Veterans $3400-$4200 to start. Overseas opportunities. Amateur or commercial licenses helpful. Full pay during advance training. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

TELETYPE OPERATORS AND CRYPTOGRAPHIC TECHNICIANS. Veterans $3200-$3700 to start. Overseas opportunities. Full pay during training period. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

THE UNITED STATES CIVIL SERVICE COMMISSION has announced examinations for Microphotographer, $2,960 to $3,670 a year, Photostat Operator and Blueprint Operator, $2,960 to $3,415 a year, and Photographer, $2,960 to $4,525 a year, for filling positions in various Federal agencies in Washington, D. C., and vicinity. Appropriate experience or training is required. No written test is required for Photographer positions, but for the other positions, a written test will be given. Further information and application forms may be obtained at many post offices throughout the country, or from the U. S. Civil Service Commission, Washington 25, D. C. Applications will be accepted by the Commission in Washington until further notice.

NEW PRODUCTS from Industry

New Computer Employs Magnetic Amplification Principal

The first high speed electronic computer utilizing magnetics throughout in lieu of filament tubes has been announced by the Remington Rand Division, Sperry Rand Corporation.

This new computer employs a new principal of magnetic amplification. These amplifiers, known as "Ferractors," are no longer than rubber erasers at the end of ordinary lead pencils. "Ferractors" will perform accurately at temperatures that range from 60 degrees below Fahrenheit up to 220 degrees above Fahrenheit.

The prototype of the electronic computer was completed in June, and present production plans will make the "Ferractor" fitted computer available early in 1957.

RCA Two-Way Radio Reduces Congestion in High Frequencies

A new two-way radio system that promises to reduce serious and growing congestion in high-frequency radio communications throughout the world has been developed by the Radio Corporation of America.

Developed for use in a wide range of fixed and mobile services operated by private, public and government agencies, the new equipment is being made available commercially through the RCA International Division and the Radiomarine Corporation of America.

The new radio, known as the SSB-1, is a complete simplex single-sideband transmitting and receiving system that cuts band-width requirements by half, yet is comparable in cost and simplicity to widely used conventional systems employing twice as much of the limited frequency spectrum.

It can be installed and used by people of little or no technical skill and is applicable to both one-way and simultaneous two-way forms of communication.

Envelope Delay Meter

A new type envelope delay meter has been developed which provides a transmitted output frequency that may be manually set or automatically swept repetitively through any desired portion of the 200 to 10,000 cps band.

This instrument is appropriate for use in studies of telephone, carrier, teletype, relay chains, facsimile, telephoto, telemeter and data transmission lines, networks and systems. Group velocity, actual transit times and amplitude-frequency characteristics can be determined over the range of 200 cycles to 10,000 cycles.

Direct reading is possible up to 20 milliseconds delay time. Higher values are read on the meter as delays in excess of 20, 40, 60, etc. millisecond periods. The receiver includes a frequency reading meter to identify the frequency being transmitted and a level meter for amplitude response measurements.

Connections are provided for monitoring the receiver by oscilloscope, or oscillographic recorder, and for external meters for delay, frequency and amplitude data.

Distortion Eliminating Voltage Regulator

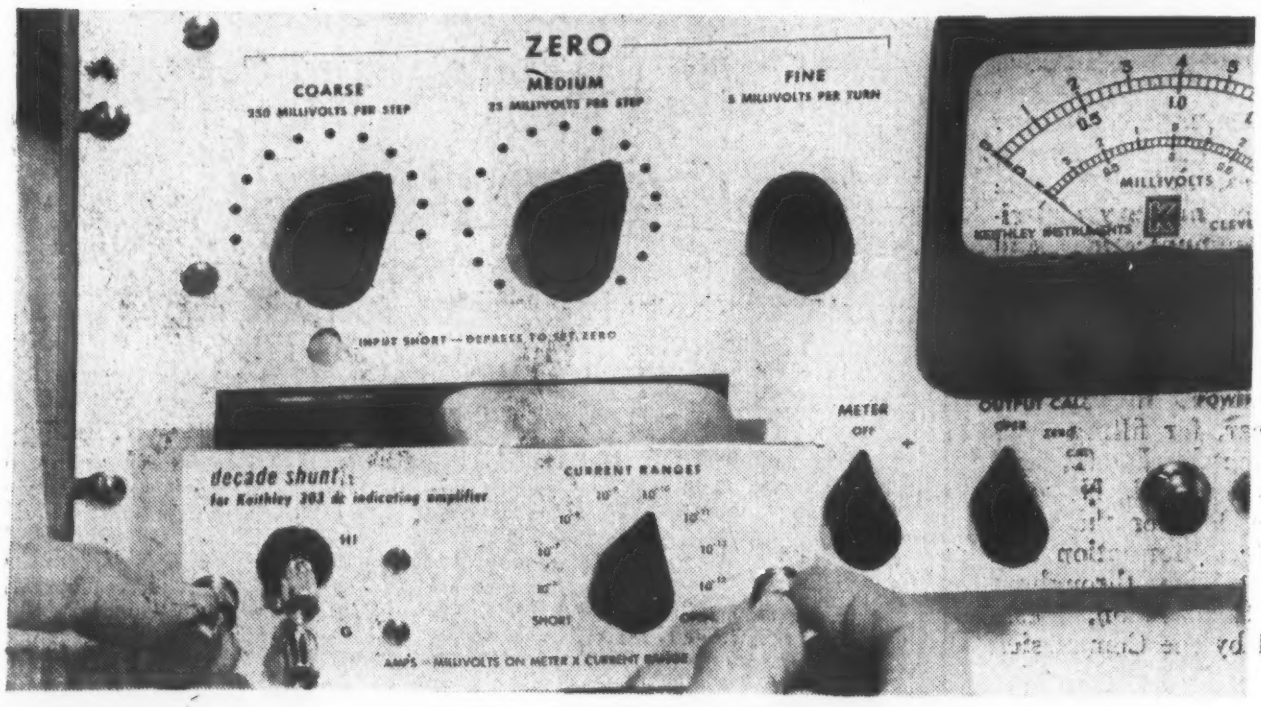
A distortion eliminating voltage regulator, expressly designed to eliminate disturbing harmonics and low frequency noise in 115v, 60 cps power sources, has been developed by the Electronics Division of the Curtiss-Wright Corporation, Carlstadt, N. J.

It furnishes 1.4 KVA of ±1 per cent electronically voltage-regulated power with line distortion reduced to less than 0.3 per cent. Recovery time is almost instantaneous, being less than 1/50 cycle. There is no phase shift between input and output.

The electromechanical regulator. unlike the usual magnetic voltage stabilizer, introduces no distortion or phase shift.

In addition to its use as a general laboratory supply for furnishing both electromechanically regulated and distortion-free, electronically regulated power, this instrument is ideally suited for preventing instability and inaccuracy in a.c. computer nulling operations.

Developed by Keithley Instruments of Cleveland, Ohio, this 303 DC indicating amplifier is available with four plug-in input panels. The decade shunt, illustrated below, converts the instrument to a direct-reading micromicroammeter. Other plug-in units include multipliers to extend the voltage range to 800 volts full scale, and a standard input panel which provides differential or single-ended input with an input impedance of over 10^{12} ohms.



Ampex Tape Transports

A new series of magnetic tape transports for the recording of information in digital form has been announced by the Ampex Corporation of Redwood City, California.

Among the uses seen for the equipment in the field of data storage and processing are the direct recording of scientific or business data in digital form, recording the output of analog-to-digital converters, feeding recorded data to the input of digital computers and recording computer outputs.

The units are able to accelerate tape to the full operating speed in less than five milliseconds and to stop the tape in the same time inter-

(*Continued on page* 82)

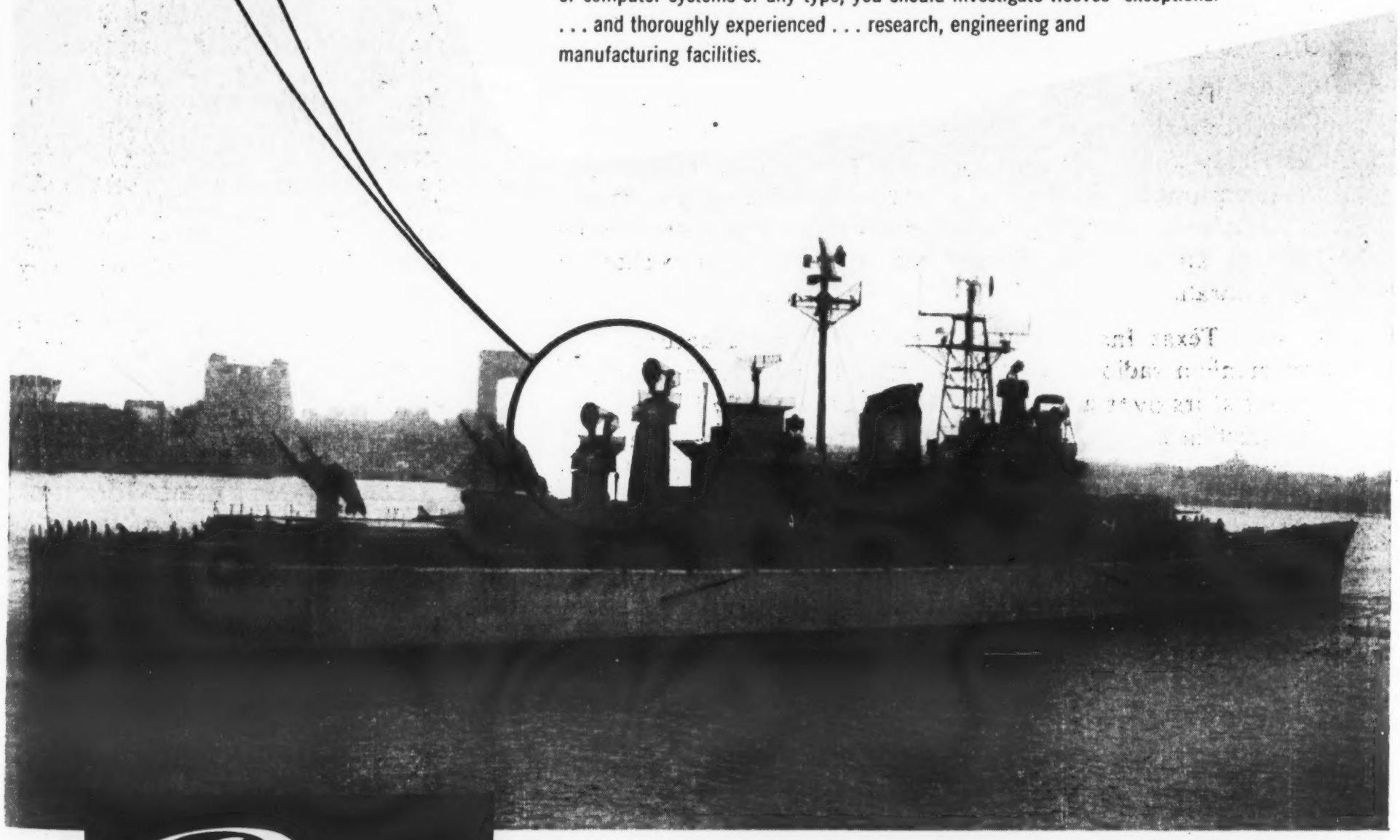
Missile Guidance by Reeves INSTRUMENT CORPORATION

IN U.S. NAVY'S FIRST GUIDED MISSILE SHIP

USS BOSTON, first of the U.S. Navy's guided missile cruisers, highlights another important advance in the continuing program of guidance systems development in progress at Reeves for the U.S. Navy Bureau of Ordnance.

Equipment installed in the USS BOSTON, born of successful experience with previous Reeves installations in USS MISSISSIPPI and USS NORTON SOUND, permits a new high degree of continuous precision control of the ship-to-air missile flight path right up to the moment of impact.

Reeves' work with the U.S. Navy and U.S. Air Force goes back to the earliest stages of their successful missile guidance programs. If you are concerned with the placing of prime or sub-contracts in the fields of missile or aircraft guidance, radar, gunfire control, servo-mechanisms or computer systems of any type, you should investigate Reeves' exceptional . . . and thoroughly experienced . . . research, engineering and manufacturing facilities.



Reeves INSTRUMENT CORPORATION

1RV56A

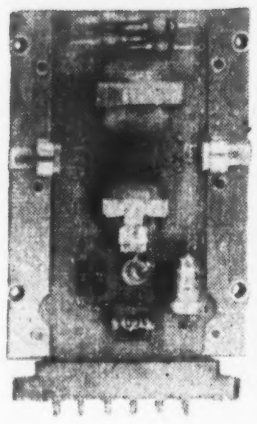
REEVES COMMAND GUIDANCE SYSTEMS

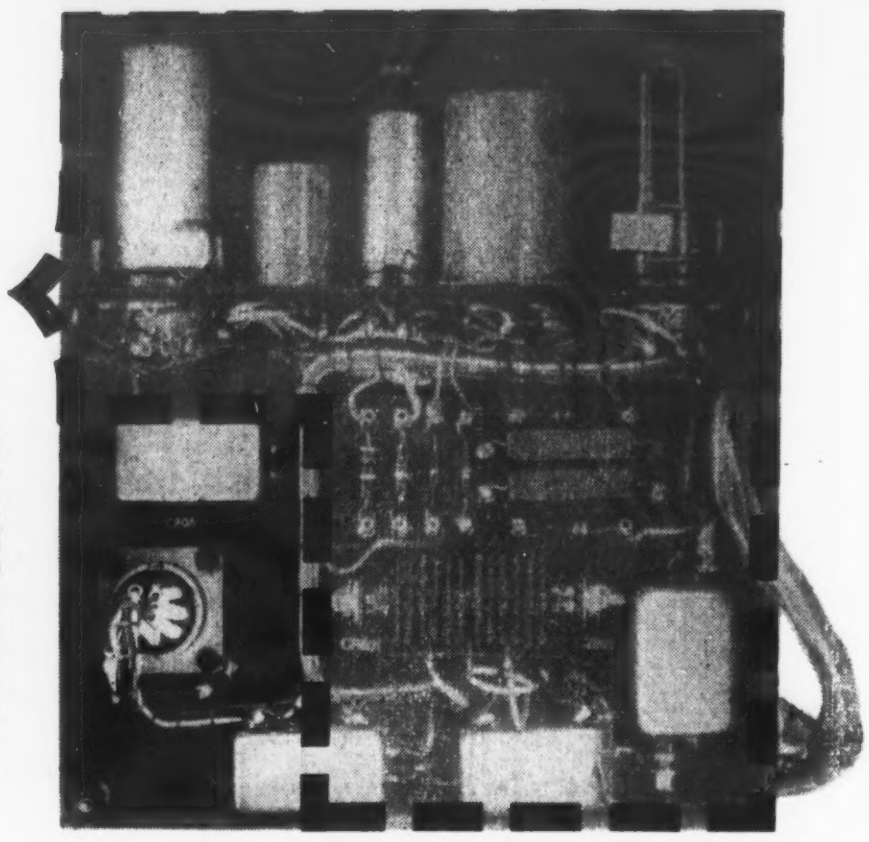
REEVES INSTRUMENT CORPORATION

A Subsidiary of Dynamics Corporation of America

215 East 91st St., New York 28, N. Y.

YOU SAVE THIS SPACE





with T/I Transistorized
ELECTRONIC EQUIPMENT

Transistorized military electronic systems are today's reality at Texas Instruments — not tomorrow's drawing board possibility! Utilizing TI-manufactured silicon transistors that far exceed MIL-T-5422C temperature specifications, TI now has transistorized military systems in production.

Typical of the savings gained through transistorization, the amplifier at left above weighs 90% less, requires 80% less space, and uses 95% less power than its vacuum tube equivalent on the right. Because of inherent transistor durability and long life, TI transistorized equipment and systems are also exceptionally reliable and resistant to shock and vibration.

Texas Instruments is the largest manufacturer of germanium radio transistors. And, since introducing silicon transistors over a year ago, TI has continually increased production and expanded its line of these high temperature semiconductor devices. This leadership in transistor development — combined with extensive military design and production experience — makes TI the leader in the trend to transistorization.

For reliable electronic systems giving you the kind of weight, space and power savings shown above, call on TI design engineers. For further information write to Texas Instruments, Apparatus Division.

TWENTY-FIFTH YEAR OF PLANNED GROWTH

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE DALLAS 9, TEXAS

NEW PRODUCTS

val. This rapid starting and stopping permits high information storage density on the tape, making the transports adaptable to the majority of digital recording and computing systems now in use.

Although functions of the transport are normally controlled electronically by a computer or other associated equipment, pushbuttons are mounted on the transport for local manual control of the forward, reverse, stop, fast forward, fast reverse, power on-off and speed selection functions. Provision is also made for a remote pushbutton station.

New Multiplier Unit For Complex Circuit Analyzing

The Electronics Division of DITMCO Incorporated of Kansas City, Missouri, has announced the addition of a new Multiplier Unit to their line of automatic circuit analyzers. This new device will enable users to test from 200 to 1200 circuits automatically at speeds up to 200 circuits in 20 seconds.

With the addition of the various multipliers and a Model 200 Circuit Analyzer, it is now possible to check the complex multiple interconnected wiring of missile and aircraft airframe assemblies wiring harness. The outstanding feature of this development is the fact that whenever engineering changes are made on the airframe wiring, or associated control wiring, a modification to the wiring harness will be the only necessary change to be made.

Visible matrix type reference charts pinpoint circuit errors; fault pattern appears readily to indicate interesting circuitry. No time is lost searching through instruction manuals.

Germanium Fused Junction N-P-N Transistors

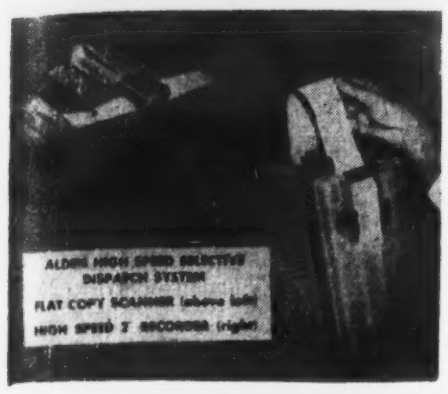
The Semiconductor Division of Hughes Aircraft Company, Culver City, California. has announced three new N-P-N fused junction germanium transistors, Types HA5001, HA5002, and HA5003.

These are medium power transistors, characterized by high gain and low noise figures. In addition, they exhibit a negligible alpha-crowding effect at high currents. This effect makes these new devices particularly applicable to high-current, medium-power amplifiers. They are also suitable for such applications as: com-

(*Continued on page* 84)

Alfax Paper *in which "ELECTRICITY IS THE INK"* plus Alden Adjusterless Recording Techniques . . . . Open Vast New Horizons in Direct Visual Recording.

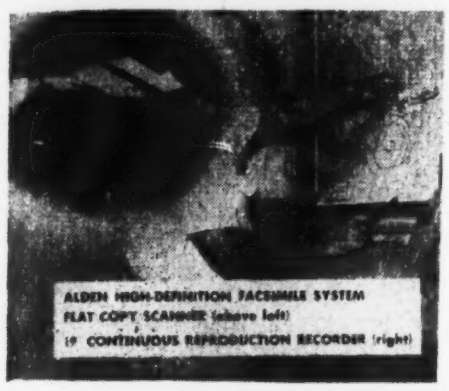
● *NEW HORIZONS* IN SPEED OF IDEA TRANSMISSION . . .



The Alden High Speed Selective Dispatch System permits selection of pertinent data from any copy, letters, dispatches, and reports—for transmission at speeds up to 72 square inches (900 typewritten, 1800 newspaper words) per minute. *Ideal for sending Vital Bursts of Information and Commands!*

Not only is the Alden System—using Alfax Paper—operated at high speeds but its high sensitivity allows large area bulletins to inform, teach or advertise—while being operated from remote positions—either permanently installed or quickly set up in the field.

● *NEW HORIZONS* IN HIGH-DEFINITION FACSIMILE TRANSMISSION . . .



ALFAX PAPER AND ALDEN ADJUSTERLESS RECORDING TECHNIQUES PROVIDE CONTINUOUS, AUTOMATIC HI-FIDELITY FACSIMILE TRANSMISSIONS.

Weather Bureau Forecasters appreciate the clarity of weather maps recorded on Alfax Paper on which they can write—make notes—erasures and then proceed with their forecasting. Businessmen and advertisers appreciate the convenience of the automatic, flat-copy scanners on which anything can be transmitted without having to be rolled around a drum. The fine definition of recordings from this system permits transmission of practically any original from front elevation, oil well logging, advertising layout, legal size documents, to strip by strip—the largest airplane or construction. This equipment operates over telephone lines without basic changes in design, or at high speeds over microwave.

● *NEW HORIZONS* IN FACT FINDING . . .

FACT FINDING WITH GROUP A RECORDERS

2 CHANNEL

30 CHANNEL

Alfax Paper has made possible a simple, two channel, unattended magazine recorder or a durably constructed multi-channel recorder (30 channels in a 5" width) for all kinds of studies, fact-finding and monitoring.

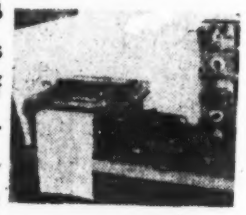
FACT FINDING WITH GROUP B RECORDERS

A complete line of recorders of all widths and speeds—covering every possible requirement for adjusterless, unattended recording—at high or low speed, using dense or weak signals—separately or combined. Plug-in unit construction permits you to impose your own designs or adaptations with these recorders.

COMPONENT RECORDERS

FACT FINDING WITH GROUP C RECORDERS

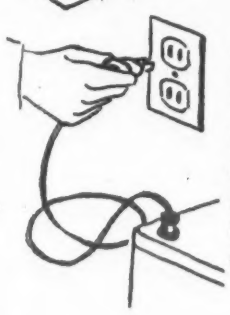
Composed of a basic Group B recorder with added electronics in a mobile unit for all types of telemetering, automatic and unattended recording from transducers, or plotting of any phenomena that can be converted to voltage.



ALDEN CURVE PLOTTER

● *NEW HORIZONS* IN OPERATING FACSIMILE EQUIPMENT . . .

SIMPLE TO INSTALL

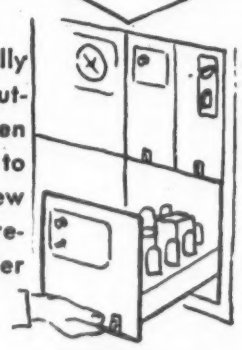


All equipment is designed for simple, "on the spot" installations. Just roll in, carry and plug in—for floor, bench, rack or machine mounting. Unit construction permits any unit to be carried by two men through door or window. Instantly set up anywhere!

SIMPLE TO OPERATE

All recorders operate virtually unattended—merely press a button and forget it! Certain Alden recorders will operate for up to eight days without requiring new paper. Flat copy scanning requires merely slipping copy under roll and pressing a button.

SIMPLE TO SERVICE



All equipment is designed on the unit construction, "building-block" principle—making it a simple matter to replace or remove mechanical parts or electronic circuits. All electronic circuits are mounted on Alden Plug-In Unit Chassis function by function.

AN INVITATION

is extended to you to visit Alden Research Center. If phoned in advance, arrangements can often be made to meet you at train or airport at Boston or Worcester.

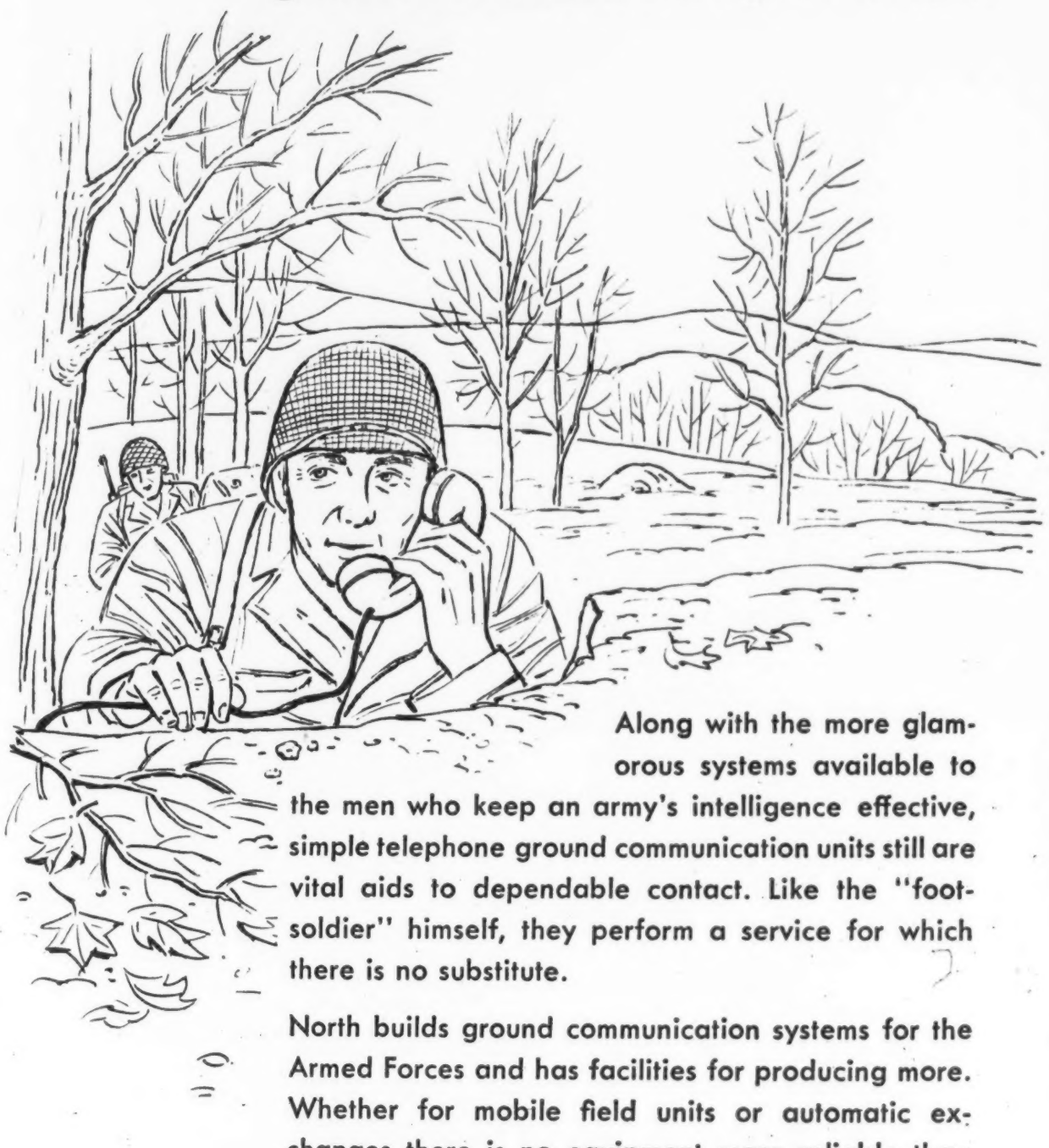
ALDEN ELECTRONIC IMPULSE RECORDING EQUIPMENT COMPANY

WESTBORO, MASS.

SEE OUR EXHIBIT

featuring our latest equipment—at the Armed Forces Communication and Electronics Association Convention in Boston, May 24, 25, and 26, 1956.

The PFC of Dependable Communications



Along with the more glamorous systems available to the men who keep an army's intelligence effective, simple telephone ground communication units still are vital aids to dependable contact. Like the "foot-soldier" himself, they perform a service for which there is no substitute.

North builds ground communication systems for the Armed Forces and has facilities for producing more. Whether for mobile field units or automatic exchanges there is no equipment more reliable than

NORTH Telephone Switching Systems

TELEPHONE DIVISION

NORTH ELECTRIC COMPANY

563 South Market Street, Galion, Ohio

NEW PRODUCTS

puters, switching, audio-amplifiers, I-F amplifiers, R-F amplifiers and oscillators.

Greater heat dissipation qualities make it possible for the devices to maintain their performance characteristics, even up to the higher power ratings. All three types have a maximum collector current of 100 milliamps, and a collector dissipation of 500 milliwatts.

Transistor elements are housed in a moisture-proof, hermetically sealed metal package. Axial leads facilitate use with printed circuits and automatic assembly.

Remote Control Closed Circuit Television System Developed

For the first time, closed circuit television installations can be remotely controlled to provide operator safety in hazardous locations, assure undetected operation in security and surveillance work, and permit quick and accurate viewing of widely spaced objectives.

This recently developed system includes a multi-lens television camera which is entirely directed by a separate monitor console. By turning the correct knob on the console, any function of the television camera can be achieved.

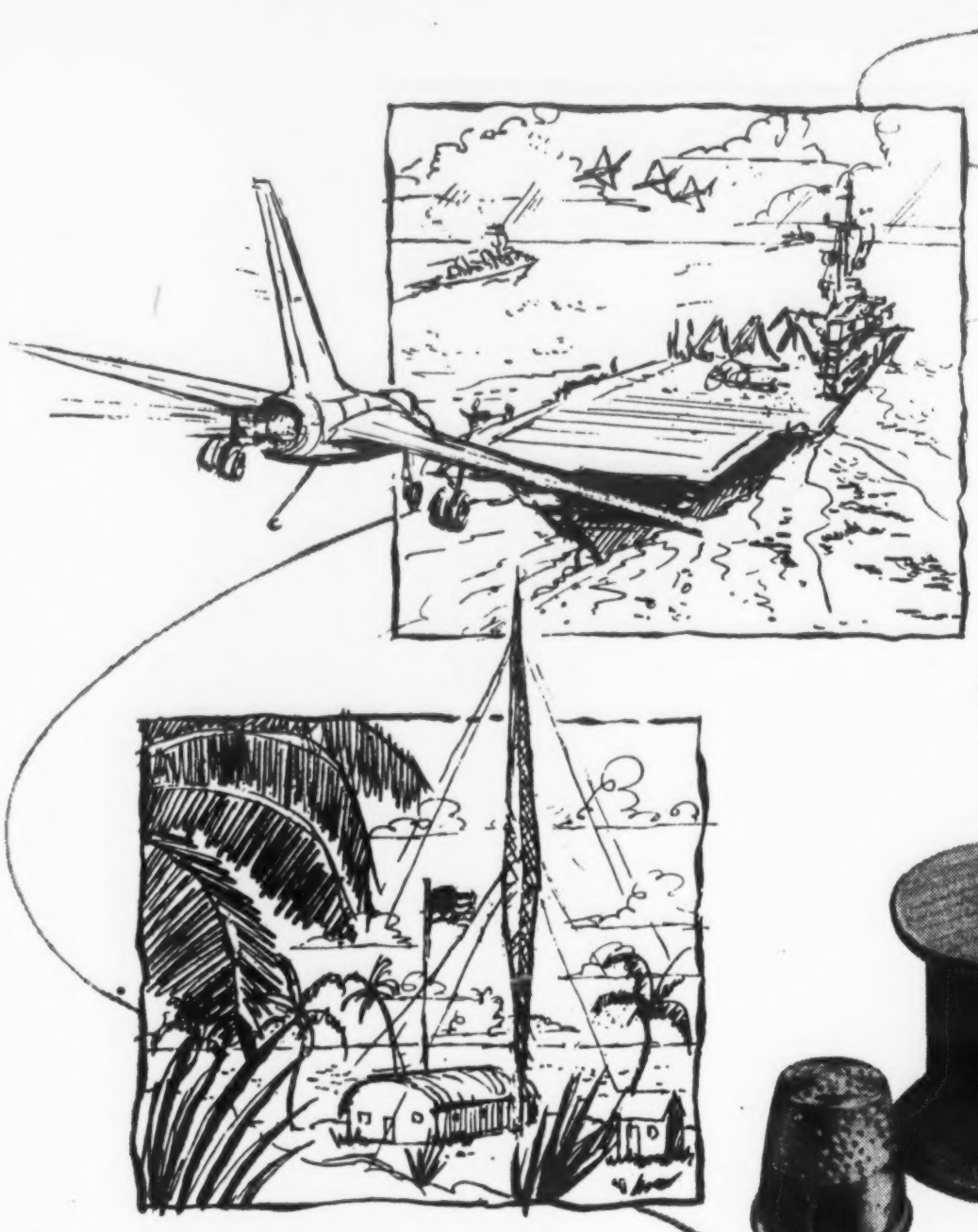
Lenses on the camera are changed, focusing is set, and the camera is directed by remote control. A built-in "memory" in the control console also makes it possible to automatically point the camera in up to three different pre-set directions simply by pushing a button. These pre-set positions, which may be readily changed to meet varying observational tasks, greatly facilitate repeated viewing of more than one area or operation.

Litton Introduces Portable Computer

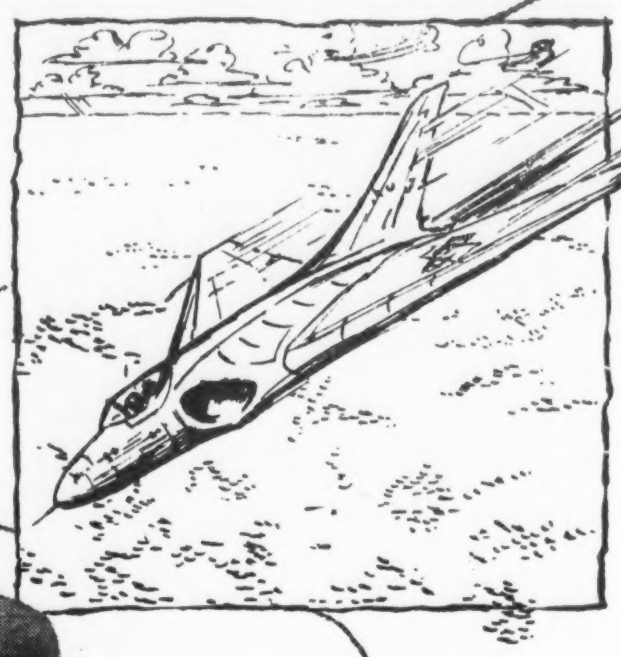
Litton Industries of Beverly Hills, California, has recently introduced a unique, portable electronic computer of typewriter size, capable of doing in one hour the mathematical computations of fifty men working for one year with modern desk calculators.

Designed to be plugged into a 110 volt wall socket, the complete unit uses only 300 watts of electricity. Currently in production, it has been available in quantity since the first of the year.

(*Continued on page* 86)



TELEGRAPH
RADIO
RADAR SONAR
TELEPHONE EQUIPMENT



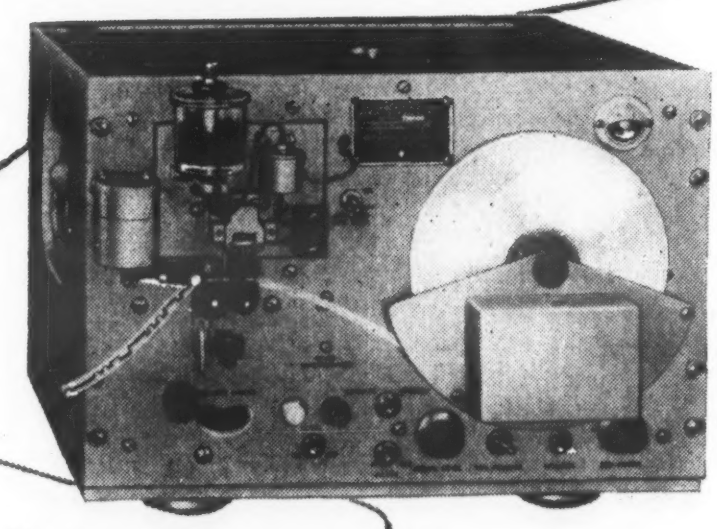
TELECOMMUNICATIONS

spins the thread that ties them all together

Lonely plane—floating carrier base—island outpost —the Pentagon—thousands of miles apart but tied together into a mighty fighting unit by the miracle of modern communications equipment engineered by Telecommunications Corporation.

Telecommunications, a leading manufacturer of this vital communications gear, as well as navigational controls and other shipboard electrical apparatus, is proud of the part it is playing in this country's growing armed might.

Like the U. S. Armed Forces, private industry, too, can depend on Telecommunications as a supplier of electrical equipment produced in quantity and quality.



Morse
Recorder
Model RAPC

telecommunications corporation

a subsidiary of the WARREN MANUFACTURING CO., LITTLETON, MASSACHUSETTS

NEW PRODUCTS

Fingertip control of the problem working in the computer, from the initial "filling" of the machine to the final solution, is provided by a five-button control panel, and the computing progress and answers can be viewed on a miniature electronic picture tube in the corner of the panel.

As an economical working tool for the engineer scientist, the new Litton computer has immediate application in both engineering and research phases of the chemical, mechanical, electrical, aeronautical and optical fields.

Heremetically Sealed Coil

A new one-piece, hermetically sealed, variable coil has recently been developed by Coil Winders, Inc., of Westbury, New York.

The molding material is an ex-poxide resin which meets military specifications for stability, resistance to moisture, and high dielectric strength.

Originally designated as a "Range Marker Coil," designed for use in military radar equipment, this unit may be incorporated into oscillator, I.F. or wave trap circuitry. Inductances in excess of 100 myh can be obtained without difficulty.

How to CONTROL and ALARM the TOWER LIGHTS of UNATTENDED Microwave and Communication Stations

PHOTO ELECTRIC PANEL
Automatically turns Tower Lights ON and OFF in accordance with FCC regulations
FLASHER PANEL - Automatically Flashes Beacon Lamps — with balanced load provisions.
ALARM PANEL - Automatically provides signals indicating failure of any lamp, power or control.

Model LC 201
TOWER LIGHTING CONTROL UNIT
(for Two Light Levels)
Model LC 101 (for Single Light Level)
Model LC 301 (for Three Light Levels)
Models also available with separate Alarm Signal for each Beacon Lamp.

Write for descriptive Bulletins

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300MM Code Beacons, Obstruction Lights, Photo-Electric Controls, Beacon Flashers, Microwave Tower Control & Alarm Units Remote Lamp Failure Indicator Systems, and Complete Tower Lighting Kits.
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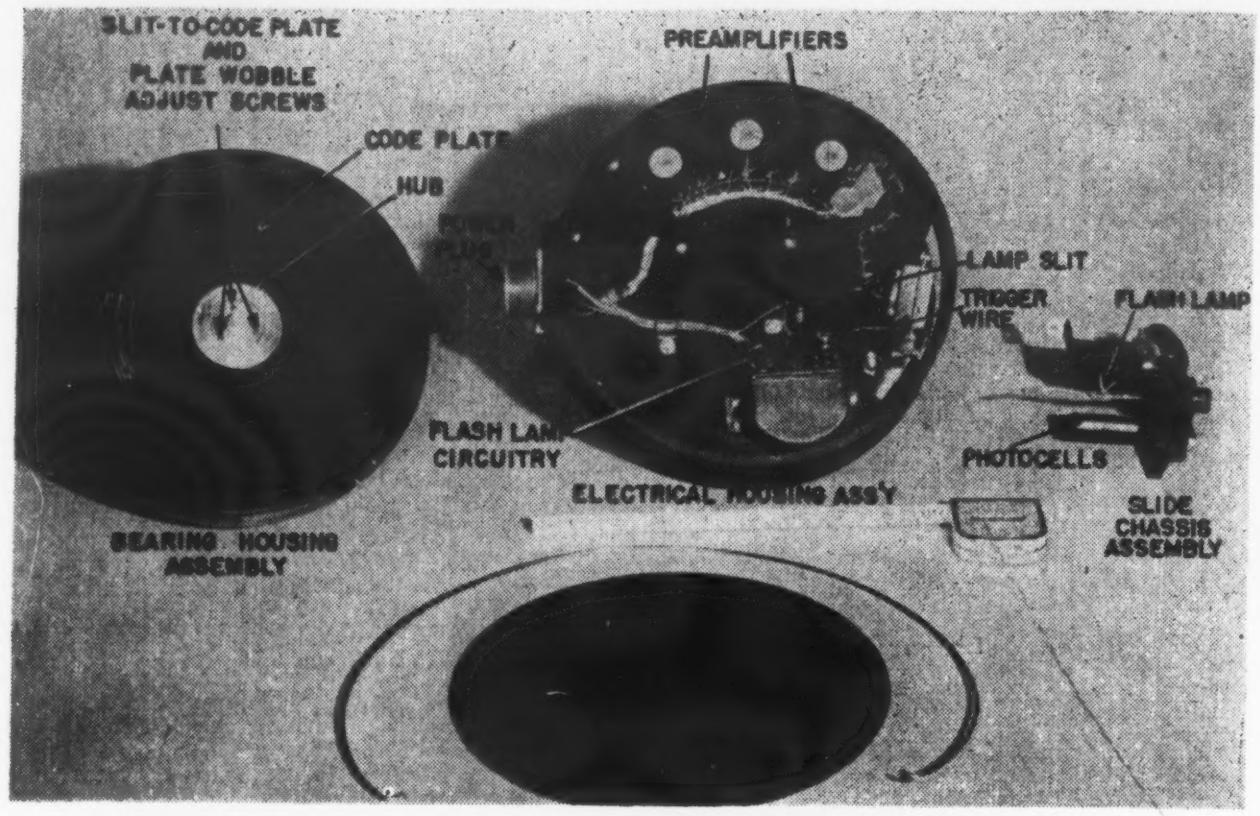
BURBANK, CALIF.



Major components of the Baldwin 16-digit encoder.

Motor-Driven Interrupter

Now available for use in automation and related work where reliability and accuracy is required is a type BC motor-driven interrupter, a standard item in telephone exchanges for many years.

Two units are available from the National Pneumatic Co., Inc. and Holtzer-Cabot Divisions of Boston. One contains from one to six circuits and the other from seven to sixteen circuits.

The drive motor is Holtzer-Cabot's widely-used 25 size with internal gear reducer, totally enclosed. The standard 115 volt, 60 cycle unit consumes only 10 watts. Machined nylon cams are used for long life. quietness and efficiency.

New Ring Rheostat For Control Equipment

A new 50 watt ring type rheostat designed specifically for use in electronic and industrial control equipment where severe mechanical shock is encountered has been developed by the Ward Leonard Electric Company of Mount Vernon, New York.

Designated as Type N152, these ring rheostats are designed to meet requirements of specification MIL-R-15109 and the high shock requirements of MIL-S-901.

The base, core and collector ring support assemblies are made of high dielectric strength glass-bonded mica. The toroidally core wound resistance wire is secured with a silicone compound, separating the turns and protecting the wire.

Baldwin Optical Angular Position Encoder

The Baldwin Piano Company of Cincinnati, Ohio, is now manufacturing 13-digit and 16-digit optical angular position encoders of high accuracy, small size, light weight and rugged construction which represent an innovation in precision analog-to-digital conversion.

Heart of the encoder is the 16-digit cyclic binary code glass disk on which the binary code pattern is applied photographically. The encoder functions with an accuracy of ± 10 seconds of arc, well within the limit which would result in the transmission of an improper sequence of numbers.

An integral part of this device is the reading head which contains a removable flash lamp, a mirror for directing the light from the flash lamp through the code disk and read-out slit, and an array of photo transistors.

To accomplish a reading of the disk at any desired instant, a stepup transformer is incorporated so that a comparatively low voltage trigger pulse will flash the lamp. At the instant of the lamp flash, the angular position of the shaft is read by the array of photocells energized by the light. The output voltage transmitted from the preamplifiers gives a faithful reproduction of the photocell output and at low impedance so that the signal can be transmitted via cable over an appreciable distance.

Satisfactory operation of the encoder is maintained over a temperature range of -55 to $+85°C$, with only ± 10 per cent change in output voltage.

NEW PRODUCTS

Brochure on Potentiometer Design and Application

A brochure entitled "A Symposium of Technical Articles" is now available from the Borg Equipment Division of The George W. Borg Corporation of Janesville, Wisconsin.

Systems engineers will be particularly interested in this new brochure covering all phases of precision potentiometer design and application. Complete information, graphs and charts covering physical and electrical design characteristics are included.

Tubeless Voltage Regulator

Development of a new tubeless AC line voltage regulator has recently been announced by the manufacturer. This regulator uses a magnetic amplifier controller circuit with a silicone diode reference element, and is basically insensitive to frequency variations.

This model is particularly applicable to unattended installations requiring highly dependable automatic line regulation. The unit is reported to offer extremely stable performance over long periods with a minimum of maintenance. Input frequency range is wide, 55 to 65 cycles. Regulation accuracy is ±0.5% against line or load.

Known as the Model MA1000S, it is available as a rack or cabinet mounted unit.

Mobile Radiotelephone For Airport Communications

Communications Company, Inc., Coral Gables, Florida, is now marketing a 6/12 volt VHF Amplitude Modulator mobile radiotelephone unit designed especially for airport vehicular ground control on airport frequencies 121.7 and 121.9 Mc.

Known as the model 278-6/12 Controller, it can be furnished for operation on any frequency in the 118-152 mc band. The transmitter has an output of 3 to 4 watts which is ample for solid mobile-to-tower communications over any airport

The Controller is interchangeable between vehicles having a 6-volt system without making any modification. This is an important feature at this time due to the number of new cars now being equipped with 12-volt battery systems.

The universal 6-12 volt feature is accomplished by using a special

(*Continued on page* 88)

Use Your Military Training

The time was never more opportune than now for becoming associated with the field of advanced electronics. Because of military emphasis this is the most rapidly growing and promising sphere of endeavor for the young electrical engineer or physicist.

Hughes-equipped Northrop Scorpion F-89D all-weather interceptor.

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or those desiring to enter these areas...

Since 1948 Hughes Research and Development Laboratories have been engaged in an expanding program for design, development and manufacture of highly complex radar fire control systems for fighter and interceptor aircraft. This requires Hughes technical advisors in the field to serve companies and military agencies employing the equipment.

As one of these field engineers *you will become familiar with the entire systems* involved, including the most advanced electronic computers. With this advantage you will be ideally situated to broaden your experience and learning more quickly for future application to advanced electronics activity in either the military or the commercial field.

Positions are available in the continental United States for married and single men under 35 years of age. Overseas assignments are open to single men only.

vibrator transformer designed for operation from either 6 or 12 volts. No dropping resistor is used with the transformer which has extremely high efficiency, giving maximum transmitter output with a minimum battery drain.

Automatic Phase Indicator

Sage Laboratories, Inc., of Waltham, Massachusetts, have recently announced their new model DAB-101 Automatic Phase Indicator.

This indicator attaches to the conventional slotted line and provides direct readings of relative phase in terms of guide wavelength. Operation of the device is based on the simple principle of similar triangles. Model DAB-101 contains two indicating devices, the slope indicator and the phase indicator.

Impedance or admittance measurements relative to a fixed point in the line can also be simply and accurately measured with this device. Repeated measurements at different frequencies can be made without resetting the phase indicator at each frequency. It can be adapted to measure relative phase on any waveguide or coaxial slotted line. Calibration of the device is permanent.

CBS-Hytron Develops Voltage Regulator Tubes

A pair of highly versatile gaseous voltage regulator tubes featuring greatly improved reliability has been developed by CBS-Hytron, Danvers, Massachusetts.

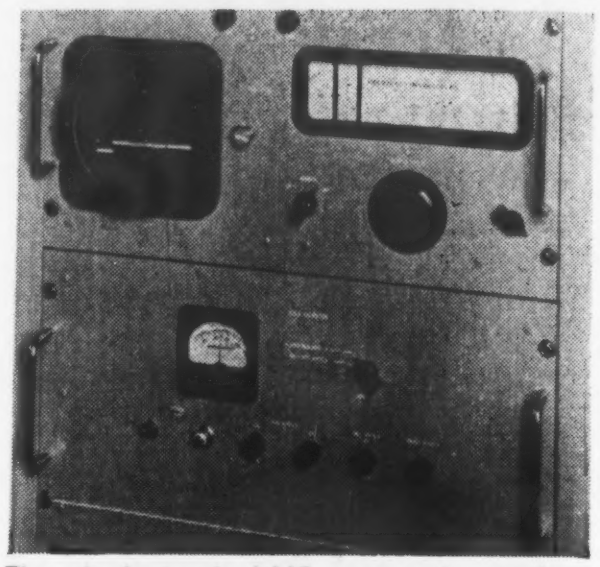
These new tube types 6626 and 6627 have important applications in the military and high quality commercial products fields, offering longer life, improved dark starting, and elimination of voltage shifts. They are recommended in such critical applications as voltage reference circuits where extreme stability and repeatability are vital factors.

To insure reliability in starting, a small amount of radio-active nickle has been incorporated in the starting electrode.

VHF Panoramic Receiver

An all-electronic panoramic receiver for very high frequency application has recently been placed in production.

Covering the range from 100 to 150 mc, this receiver features three controllable inductor tuned RF stages in a double-superheterodyne circuit which provides more than 60 db attenuation of all spurious responses



The all-electronic VHF panoramic receiver.

and a noise figure no greater than 13 db throughout the tuning range.

Seven inductor tuned circuits operate without moving parts to provide vibration-free operation and virtually unlimited life. A precision marker circuit permits frequency measurements on observed signals to an accuracy of better than 1 per cent.

Received signals are displayed logarithmically on a five-inch, flatface cathode ray tube. A dynamic range of 60 db is presented as a 6 to 1 variation in observed amplitude.

The front end of this receiver features a low-noise, cascode RF amplifier followed by two double-tuned RF stages for maximum rejection of spurious signals. High gain and selectivity are then provided by two 30 mc IF amplifiers and three more IF amplifiers operating at 3 mc. The latter stages provide an effective bandwidth for the receiver of only 30 kc for high resolution of closely spaced signals.

Triad Replacement Transformers

Three new Correct Replacement Flyback transformers have recently been added to the line of television replacement transformers manufactured by Triad Transformer Corporation of Venice, California.

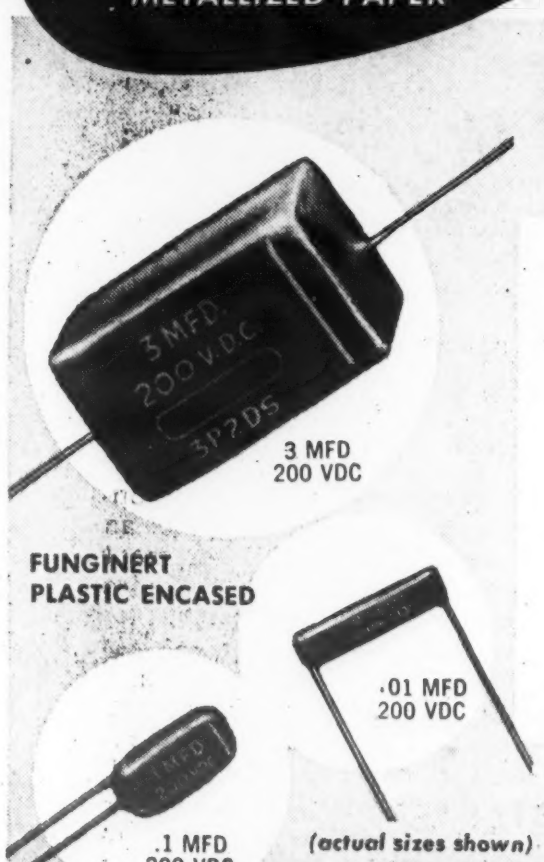
Designed for use in Sylvania television receivers, these new items are electrically and mechanically interchangeable with the manufacturer's original equipment.

Metallized Hermetic Terminals

New high-strength, high temperature Metalized Hermetic Terminals of Alumina ceramic have been added to the AlSiMag line of American Lava Corporation of Chattanooga, Tennessee.

(*Continued on page* 90)

NEW SUBMINIATURE METALLIZED PAPER CAPACITORS



NEW LEAD LOCATIONS AVAILABLE — Axial leads • Radial leads • Single End parallel leads in all capacitor sizes.

- Resin impregnated and rectangular shaped for maximum space conservation.
- Completely encased in a non-nutrient plastic for maximum fungus and humidity protection.
- Operating temperature range −55°C to +100°C.
- Temperature coefficient +.07%/°C.
- Excellent capacity retrace.

A variety of sizes are available. Also, special designed units made to exact specifications.

Also, NEW subminiature HY-THERM CAPACITORS for all applications requiring exceptionally high insulation resistance and unusual stability at high temperature.

HOPKINS Engineering Co.

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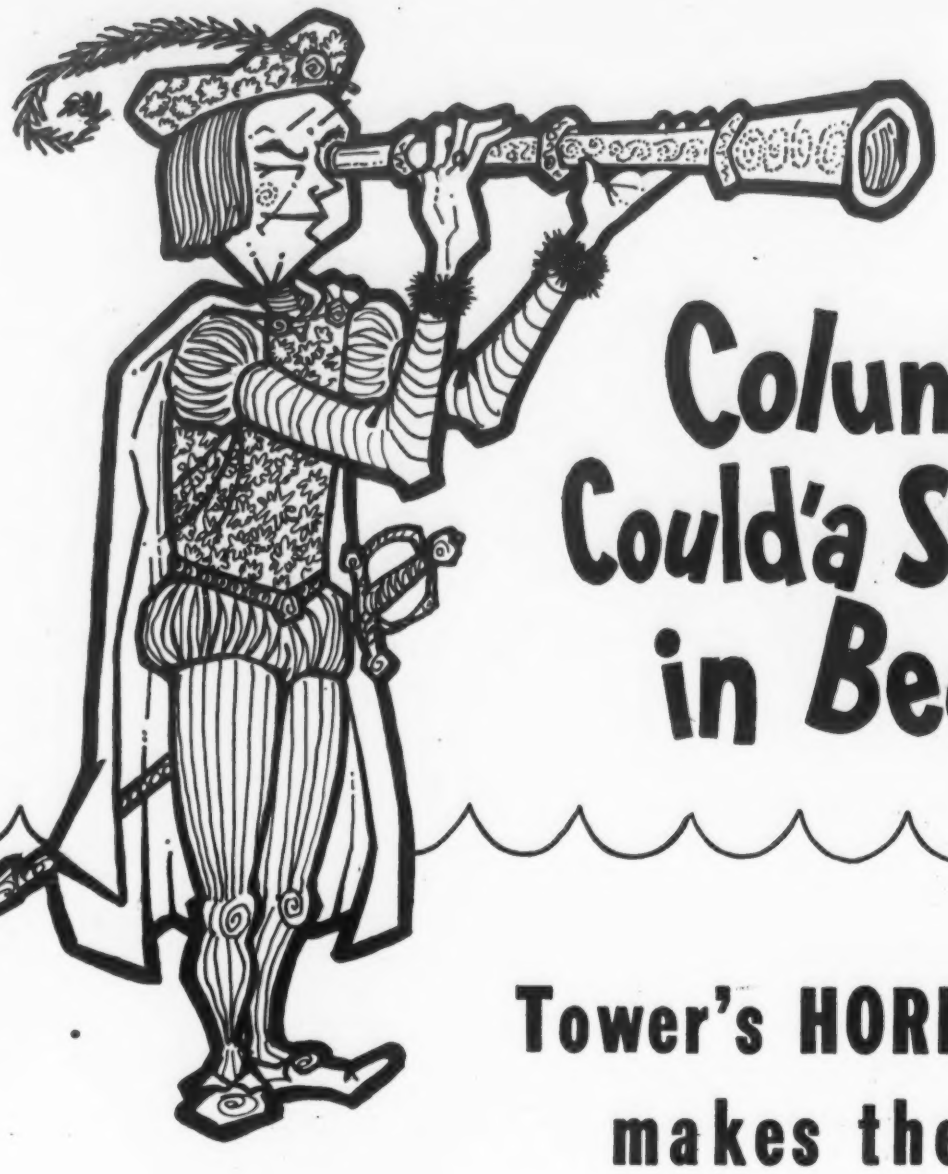
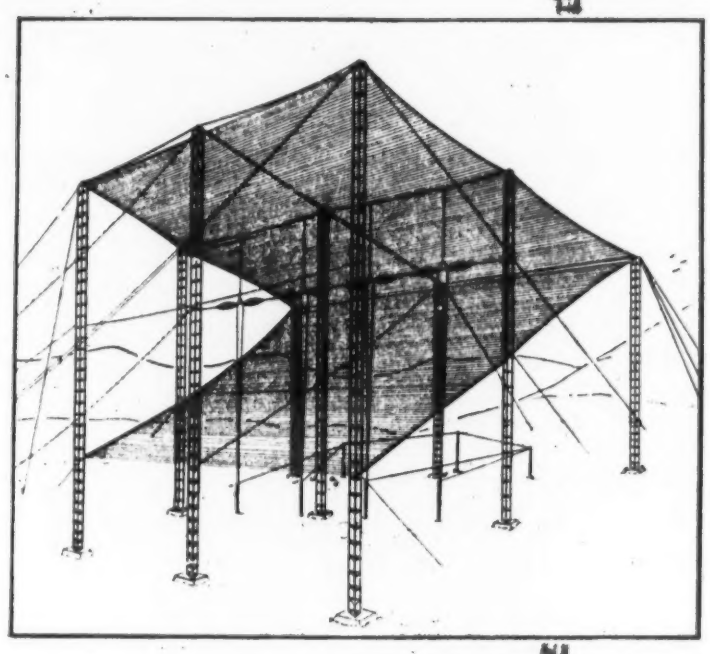


Columbus Could'a Stood in Bed...

Tower's HORIZON STRETCHER makes the earth FLAT

POOR CHRIS went to a heap of trouble to prove that the Earth was not flat, then TOWER came along and "flattened" it out again. Mr. C's "round" earth caused too many problems with FM signals. They just couldn't be "read" beyond the horizon. That is, until TOWER engineered, fabricated, and erected the first successful High Gain Corner Reflector Antenna installation (insert) to receive FM radio and TV signals far beyond yesterday's horizons.



A pioneer in "Scatter Propagation," TOWER has proven again that knowledge, gained through experience, sets the pace for TOMORROW . . . today!

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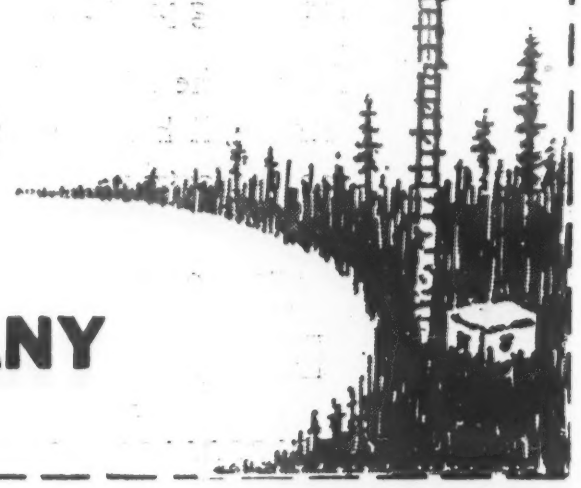
CONSTRUCTION COMPANY

Sioux City, Iowa



These terminals may be installed by silver soldering at temperatures up to 750° C. Copper brazed terminals are also available for still higher temperature applications. The range of operating temperatures is thus extended well above that of the earlier soft solder terminals.

Superior characteristics of AlSiMag 576 and AlSiMag 614, teamed with new and efficient high-temperature metalizing techniques, offer obvious advantages to the design engineer seeking more reliable terminals. Among these advantages are: ultra low loss ceramic with an improved glaze of superior surface resistance; permanent, leak-tight bonding, and resistance to thermal shock.

For the Photographer

Two New Films Announced By Kodak

Two new films, bearing names long known in the photographic field, Panatomic-X with new emulsion and Plus-X increased in speed, have been announced by the Eastman Kodak Company, Rochester, New York.

Properties featured in the new Panatomic-X film are: extremely fine grain, greater exposure latitude and rapid processing. These properties are obtained through the use of entirely new emulsion and coating techniques, it is said.

The new emulsion, claimed to be thinner than that of any previous micro-grain film on the market, is also said to be made up of smaller, more uniformly dispersed silver grains. Because of the uniformity with which the silver is distributed, there is no loss of highlight density in spite of the thinness of the emulsion. Speed of the film is rated at ASA 25 daylight, 20 tungsten. Kodak Panatomic-X Film will be available in 35mm magazines and 828, 127, 120, and 620 rolls.

Kodak Plus-X Film, a medium speed film with moderate grain, has been upped in speed and introduced in the 35mm size. This miniature film now falls midway in speed between the new fine-grain Panatomic-X Film and Kodak Tri-X Film. The ASA rating for the new Plus-X is 80 daylight and 64 tungsten as against the prior rating of 50-40.

With the increase in speed is said to go an emulsion change resulting in a finer grain than was previously available and a higher acutance. "Acutance" is a word coined by the Kodak Research Laboratories to describe a measure of the image-sharpness of a film. The high acutance of this film, like that of the other new Kodak films, to said to result from a better dispersion of silver in the emulsion. As a result, there is less scattering of light by the silver grains and shadow and highlight areas are more sharply defined, with "mushiness" virtually eliminated. Minimum grain size in the emulsion is retained with regular fine-grain developers. Recommended development is for eight minutes in D-76.

The new Kodak Plus-X Film will be available only in the 35mm size. 20 and 36 exposures.

Fairchild-Odelca Photofluorographic Camera

Designed especially for medical and industrial x-ray work, a new camera, the Super Speed Fairchild-Odelca, using 70mm film, has been announced by the Fairchild Camera and Instrument Corporation, Syosset. New York.

The new camera is claimed to possess an unequaled combination of definition, contrast and speed which is accomplished by the use of concentric mirrors and cone lens correcter, the latest development of reflection type optices. It is said to provide the most powerful optical system known for the production of photo radio graphs of superlative quality.

The large relative aperture of f/0.63 of the camera makes for extremely short exposure times without neglecting the requirements of definition. It has a working aperture of f/0.8 as compared with the highest operable lens speed of f/1.5 attained by photofluorographic cameras employing a refractive lens.

This new high definition camera is an advance so definite, as greatly to widen the scope of photofluorography, both medical and industrial. Single pictures can be conveniently taken for immediate processing and viewing. Because the camera produces high definition it also can be an aid in the detection of mechanical failure and design weaknesses in numerous industrial applications.

A motorized casette, with a speed up to six exposures per second, has been provided giving complete versatility. Other features of the camera package include picture identification, automatic exposure control and processing and viewing equipment. Four other types of film casettes are adaptable to the camera unit, ranging from a single cut film casette to the Fairchild Mark X-100, with a loading of 100 feet of roll film to provide approximately 350 exposures.

Just a minute—

Please don't get us wrong . . .

we like **quantity** *business, too*

Just the other day an engineer told us: "I'd have asked you to quote on this order if I'd only realized you handled quantity production. But, somehow, from your ads, I got the impression that you specialized in custom-built transformers in very small quantities only."

"Whoa!" we shouted. "Sure we specialize in custom-built transformers, but we can make 'em custom built or standard in whatever quantity you need. And we can do it quickly without sacrificing precious quality control."

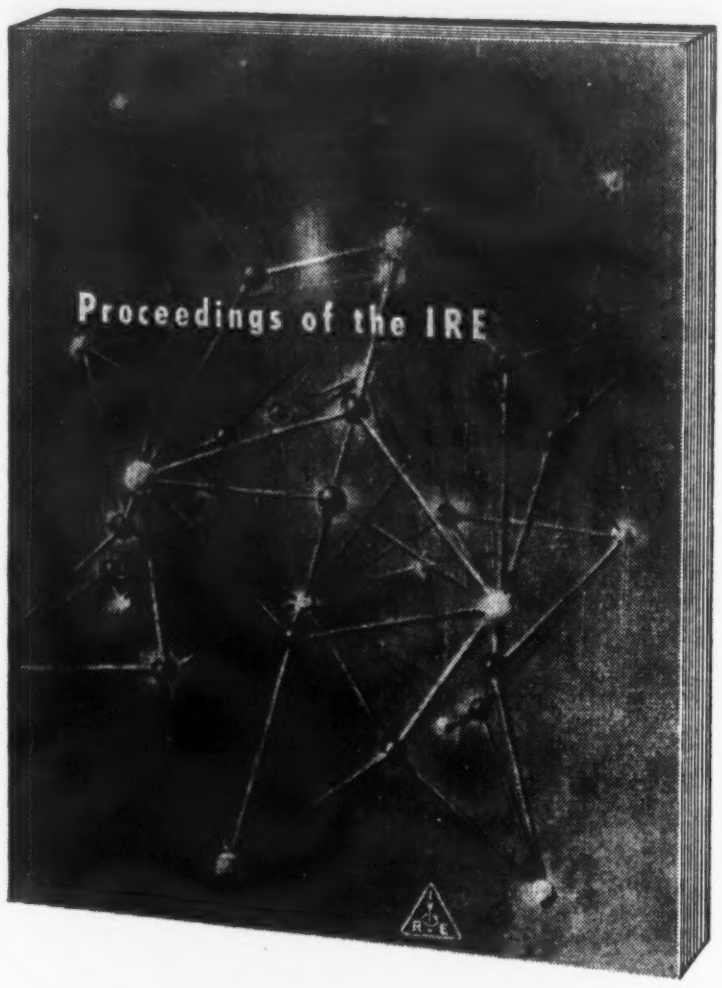
Maybe the fact that we can handle large quantities will help you. Why not write and ask for more information.

CALEDONIA

ELECTRONICS AND TRANSFORMER CORPORATION

Dept. S-1, Caledonia, N. Y.

What is "solid state electronics"?



You have already received great services from "Solid State Electronics"... but much more is coming your way!

This side of radio science is both old and new. It started with the galena detector which gave you signals you could hear. In phosphers that glow in response to electronic bombardment, it gave you, first, a picture tube—and now, full color television.

Ferrites that store and repeat electronic signals—the memory elements of the computer—are the next stage in this radio engineering. Tomorrow, "steareatronics" (as Cornelius Ryan calls it in Collier's) will provide silicones and other solid state materials which will store heat and power from the sun to serve you.

A working summary of this science is offered to you in the December issue of "Proceedings of the IRE"—from background data to the newest research. This one issue, some 300 pages, is the word count equivalent of a 600-page text book . . . useful, up-to-the minute. It is a history-making issue you will treasure for years.

Price to non-members . . . **$3.00**

(All IRE members will receive this December issue as usual. Extra copies to members, $1.50 each.)

Every Article Is a "Treasure" in this History-Making Issue

"Lead Article," by Dr. Frank Herman, RCA Laboratories, Inc.

"Field of Ferrites," a paper covering the history of the development of ferrites, by Dr. E. W. Gorter, The Philips Co.

"Ferrite Developments," by Dr. Paul N. Russell

"Historical background and current state of the art in dielectric materials," by Dr. E. T. Jaynas, Stanford University

"Future trends and unsolved problems in dielectric materials," by Dr. Gen Shirane, Pennsylvania State University

"History of Semiconductor Research," by G. L. Pearson and W. H. Brattain, Bell Telephone Laboratories, Inc.

"Germanium and Silicon," by G. A. Morton and M. L. Schultz, RCA Laboratories, Inc.

"Conductivity, Hall effect and optical absorption of intermetallic compounds," by Dr. H. P. R. Prederikse, National Bureau of Standards

"Photoconductivity in some of the sulfides and selenides," by Dr. Richard H. Bube, RCA Laboratories, Inc.

"Performance of Photoconductors," by Dr. Albert Rose, RCA Laboratories, Inc.

"Lead Salts or Infra-red Photoconductors," by T. S. Moss

"Design & Performance in a Storage Light Amplifier," by Rosenthal Jennie, Allen B. Dumont Labs.

"An Electroluminescent Light, Amphtyme Picture Panel," by B. Kazan and F. H. Nicoll, RCA Laboratories, Inc.

"Cathodoluminescence," by Dr. G. F. J. Garlick, University of Birmingham

"Electroluminescence," by Prof. Georges Destriau and Dr. Henry F. Ivey, Faculte des Sciences de Paris

"Physical Chemistry of Phosphors," by Dr. F. A. Kroger, The Philips Co.

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☐ Enclosed is $3.00

☐ Enclosed is company purchase order for the December, 1955 issue on "Solid State Electronics"

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SO YOU WANT TO BE A HAM. Robert Hertzberg, Howard W. Sams and Co., Inc., Indianapolis 5, Indiana, 196 pages, $2.50.

This book is intended to get beginners of all ages off to a good start. In twelve well-defined, illustrated chapters, the prospective ham will find what he needs to know about getting his license and his equipment.

A thorough explanation is given regarding what license requirements must be met; how to learn the code painlessly; how to select and buy equipment; how to be a good operator, and of special and particular value to young men, some pointed information dealing with the place of the radio amateur in the military service and with electronics as a lifetime career.

Aimed directly at the individual who wants to know about becoming a licensed amateur, this text will take the mysteries out of the subject.

THE ORDNANCE DEPARTMENT: PLANNING MUNITIONS FOR WAR. Constance McL. Green, Harry C. Thomson, and Peter C. Roots, Office of the Chief of Military History, Department of the Army, Washington 25, D. C., 542 pages, $4.25.

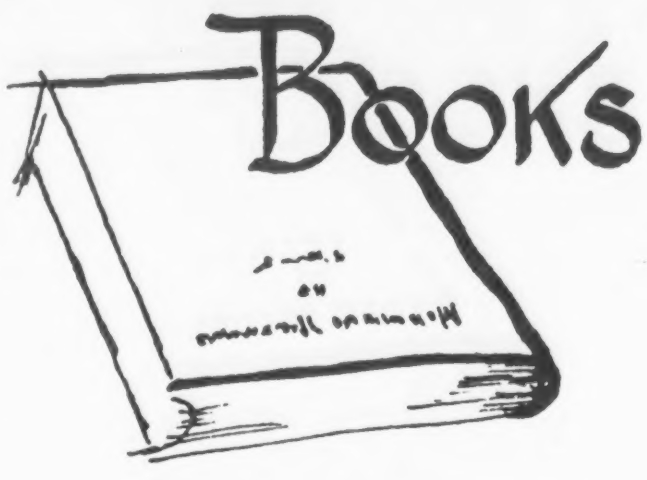
Planning Munitions for War tells the story of the vital behind-the-scenes work of designing and developing the U.S. Army's fighting equipment for World War II. This is the 27th volume to be published in the Army's monumental history of World War II and the first of three projected volumes on the Ordnance Corps.

This volume opens with an introduction that places the Ordnance Corps in its proper setting within the military framework and describes in broad terms the manifold Ordnance responsibilities for research, development, procurement, storage, distribution, and maintenance of the Army's fighting equipment. It then summarizes the Ordnance Department's history from the period of the American Revolution down to 1940.

The authors devote several chapters to the poverty of the pre-war years, which allowed Hitler's army to gain valuable ground, and they criticize the Ordnance Corps and its leaders for not pressing more insistently for bigger appropriations to stop the steady obsolescence of the nation's fighting equipment.

Based on interviews and correspondence, this book tells for the first time the full story of the nomination of Maj. Gen. James H. Burns as Chief of Ordnance and the later withdrawal of the nomination at General Burns' request.

The authors include a summary of all the major elements in the World



War II picture. They do an excellent job of bringing the reader up to date on Ordnance Corps activities as well as pointing out mistakes of the past, putting blame where it is deserved and praise where it is merited.

FUNDAMENTALS OF TELEVISION ENGINEERING. Glenn M. Glasford, McGraw-Hill Book Company, Inc., New York 36, New York, 642 pages, $12.75.

Here is an up-to-date reference book that gives a thorough theoretical coverage of the entire field of television. Written from an analytical point of view, both systems concepts as well as circuits and techniques are discussed in detail, showing how the large body of scientific knowledge is applied to the analysis and design of individual parts of the television system.

The book first considers the necessary elements and the desirable standards in developing a television system on the basis of the characteristic of the terminal device, the eye, and the general psychology of the observer. It then makes a study of the principles of transducers, circuits and devices, the problem of noise in low-level signal circuits, recent important advances in the field, such as UHF and color television, and closes with a set of problems designed to illustrate and amplify specific points in the text.

A comprehensive book, well illustrated with line drawings and photographs, *Fundamentals of Television Engineering* emphasizes the television system itself, the requirements to be met in achieving a desired overall quality, and the analysis and design of the many component parts which make up the system.

Our Book Department can furnish any book currently in print. We will also help to secure older copies that you may need to complete your library. A 10% discount allowed all Association members on orders of $10 or more. Please indicate author and publisher where known and allow three weeks delivery.

PHYSICAL MATHEMATICS. Chester H. Page, D. Van Nostrand Company, Inc., Princeton, New Jersey, 329 pages, $7.50.

The average graduate student of physics is usually confused by the variety of mathematical tools employed. Mathematics is used as a means to an end, the physical results and the tools are of secondary interest,, but lack of understanding of their tools and their relation to one another is too prevalent among physicists.

This book attempts to explain some of the classical mathematical techniques from the viewpoint of a physicist, using physical arguments freely to indicate propositions to be tested.

Integration is introduced as being basic in physics, wi h differentiation a secondary process. Simple phenomenological equations are set up from both integral and differential viewpoints, and the properties of the solution investigated. Among the methods considered and interpreted in terms of problem-solving are those of Fourier and Laplace.

Helping physicists to correlate their smatterings of mathematical knowledge in such a way as to improve their feeling for the subject and increase its usefulness is one of the main objects of this book.

SEIZURE OF THE GILBERTS AND MARSHALLS. THE U. S. ARMY IN WORLD WAR II SERIES. Philip A. Crowl and Edmund Love, Office of the Chief of Military History, Department of the Army, Washington 25, D. C., 414 pages, $5.75.

If history is the story of events as they actually happened, *Seizure of the Gilberts and Marshalls* should satisfy the most exacting scholar and critic.

This, in a capsule, is the story told in *Seizure of the Gilberts and Marshalls*. Although emphasis is placed on the activities of the Army, the roles of the Navy and Marine Corps are by no means neglected. Nor is this only the story of infantry action. Tank operations, close air support of troops, medical operations, troop training and logistics receive their full share of attention.

Drawing on the voluminous Army, Navy and Marine Corps, as well as Japanese, files, the authors, both veterans of the war in the Pacific have combined text with maps, photographs, charts, and tables to bring to the reader an authentic picture of amphibious warfare.

Veterans of the Gilberts and Marshalls campaigns should find the account an absorbing one. Readers with a general interest in military

history will discover in this volume a model case study in the art of amphibious war. Members of the armed forces who must concern themselves with the many complications of joint operations will find the work a valuable text book.

LAPLACE TRANSFORMS FOR ELECTRICAL ENGINEERS. B. J. Starkey, Philosophical Library, New York, 279 pages, $10.00.

The engineer is continually requiring more and more tools from the mathematician. One of the methods of analysis which has become important for engineers in recent years is that involving the Laplace transform.

The method of solving linear differential equations has been in use by mathematicians for well over a century, but only in recent years have engineers begun to realize its usefulness to them. The Laplace transformation is extremely helpful in providing quick solutions to a great range of engineering and physical problems and often saves much calculation by other methods.

Normally, the language used by engineers does not go beyond differential and integral calculus. This book, however, uses language particularly familiar to electrical engineers and well known to engineers in general.

The use of a physical, rather than a purely mathematical vocabularly helps attain simplicity and the subject is approached from well known analytic methods. This work is not intended as more than a general introduction to a very large subject, but it will be of value in supplementing the more rigorously mathematical texts which have previously appeared.

ASSAULT BATTLE DRILL. Major General James C. Fry, USA, The Military Service Publishing Company, Harrisburg, Pennsylvania, 114 pages, $2.00.

This superior training text on infantry assault tactics is designed to indoctrinate combat troops so that they will correctly apply sound methods during the critical advance of the last 100 yards—and live to take and hold the objective.

General Fry questions the old saying that "troops have to be blooded" and can only learn the hard way. He shows how soldiers can be taught, through repetitive drills, to coordinate their efforts so that each soldier can move with assurance based on a knowledge of what his comrades are going to do and how his own behavior fits into the entire scheme of action.

His book expands official doctrine to explain the vital details and techniques of application that are not covered in field manuals.

In a foreword to *Assault Battle Drill*, Lieutenant General James M. Gavin, USA, formerly Deputy Chief of Staff for Plans and Research, and now Chief of Research and Development for the Army, states: "One's first small-arms fight is a poor laboratory in which to experiment. It is far better to have a reasonably good plan and close with the enemy aggressively at once. *Assault Battle Drill* provides this plan, not only for the first fight, but for those that will follow."

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, etc., required by the act of Congress of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946, of SIGNAL Magazine, published bi-monthly at Washington, D. C., (additional entry, Baltimore) for October 1955.

District of Columbia }
City of Washington } ss.

Before me, a notary public, in and for the State and County aforesaid, personally appeared George P. Dixon, who, having been duly sworn according to law, deposes and says that he is the Editor of the SIGNAL Magazine and that the following is, to the best of his knowledge and belief, a true statement of the ownership and management of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher: Armed Forces Communications and Electronics Association, 1624 Eye St., N. W., Washington 6, D. C.

Editor: George P. Dixon, same address.

Managing Editor: Paula Sue Burns, same address.

2. That the owner is: (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.

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GEORGE P. DIXON,
Editor.

Sworn to and subscribed before me this 30th day of September, 1955.

(Seal) MARIANNA D. WAGGAMAN,
Notary Public.

(My commission expires April 14, 1957)

MOBILE COMMUNICATION CENTERS

Radio Engineering Products has been continually in production of mobile communication centers for various NATO headquarters and for the U.S. Signal Corps Engineering Laboratories, over a period of several years. The centers produced have included type AN/MSC-1, type AN/MSC-5, and type AN/MSC-12, which have been or are being manufactured in full accordance with U.S. Signal Corps specifications. There have also been produced systems engineered by us to the specific requirements of a headquarters.

These systems have employed in some instances trailers and tractors of modified commercial types supplied by us, in some instances standard military-type vehicles supplied by us, and in some instances the using agency has supplied standard military-type tractors, trailers and trucks.

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- **Teletype switchboards up to 120 lines.**
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They solved a tough problem that faces all television broadcasters. Thanks to their ingenuity, a lot of viewers probably enjoy their TV more, without knowing why.

The American TV system is based on advertising sponsorship. Programs are sprinkled with a husky lot of commercial slides telling the story of products from A to Z.

There's the rub. Slides ought to be just as clear and non-glaring and undistorted and easy to look at as the program material itself. But artwork for reproduction is often all over the lot—some light, some dark, some on shiny paper, some on dull. Put on the air "as is," it can be pretty unsatisfactory. We wanted something better for the million-odd people in the area served by our station, WHAM-TV.

Enter some typical Stromberg-Carlson ingenuity. Three of our boys got to playing around with a machinist's milling vise, a 35mm amateur camera, and some polarized lights and filters. The result is the photo-copying device at which the men above are looking. It makes up for art deficiencies, and is so constant in exposure that a dozen different operators will produce slides of exact quality. It even has some tricky handles and wheels which enable us to create animation with still pictures!

This solution is typical of Stromberg-Carlson's challenge—"What do you mean, it can't be done?" If you have at hand a puzzle in Electronics or Communications, for *any* purpose, we'd like to tackle it.

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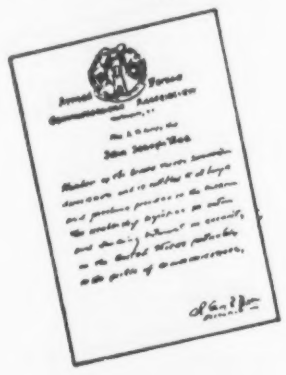

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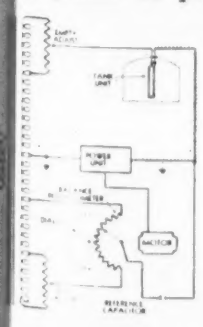

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